Public Works Engineers' Yearbook

1940

Public Works Engineers Yearbook

1940

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FOREWORD

FOR MANY years public works officials of cities, counties, states, and the federal government have met together annually to share their experiences and to cooperate in seeking solutions to their common problems. This annual meeting has been termed the Public Works Congress since 1935 and for the past three years it has been held under the sponsorship of the American Public Works Association. The 1939 Public Works Congress was held in Pittsburgh in October; its proceedings are included in the present volume.

In addition, this 1940 *Public Works Engineers' Yearbook* contains a great amount of material which was prepared especially for it by acknowledged authorities in the fields of discussion. This special material comprises a number of reports on specific topics of timely interest not covered by the discussions at the Pittsburgh meeting.

Although the material in the present volume is derived from these two sources, the editor's object has been to present a well organized picture of current public works problems. With this end in view, topics are arranged with regard to their functional relationships rather than in regard to the manner in which the material was first presented.

FRANK W. HERRING,
Executive Director

Chicago, Illinois
April, 1940

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Public Works Engineers' Yearbook

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The Federal Works Agency

JOHN M. CARMODY*

Administrator, Federal Works Agency, Washington, D. C.

THE GROWTH of America may be measured in several ways. An important index of the rise of our civilization is to be found in the volume and type of public works which render service to the people. We are a nation of builders. We have built everything from abattoirs and airports to water works and zoos. As our population increased, as our country expanded territorially, as our people grouped themselves together for local self-government, we attempted to keep pace with the ever-growing demand for common public services.

In our desire and rush to meet our needs we have unfortunately not always built intelligently. There was no direction to our efforts. We permitted too much to depend upon chance. Personal and political consideration often determined the types of public works we undertook. Little heed was given to the future. We were too busy trying to meet the needs of the day.

In retrospect, it seems to me, all that did not matter so much. We were far behind. A use could be found for whatever was built. We were so busy coping with the problem of the moment that it did not occur to most of us to think of the problems that might arise to plague us later. We did not plan.

As long as a man confined himself to vague remarks about the glorious future of the nation or the home town, he was all right. He was regarded as a patriot and civic-minded citizen. But the moment he became so specific as to speak of a possible six-year or a ten-year plan of public works, he was put on the spot. Either he was an idealistic visionary—a dreamer—or had been corrupted by foreign gold. After all, didn't Soviet Russia have a five-year plan; and didn't Nazi Germany have a four-year plan? Moreover, one's forefathers did not plan, and they got along all right. Therefore, it was argued, planning was un-American.

But this attitude has recently undergone a healthy metamorphosis. This new outlook has sprung primarily from two sources: First, our

* As Mr. Carmody was unable to be present, his paper was read by Mr. F. E. Schnepfe, Director, Projects and Planning Division, Public Works Administration, Washington.

extensive experience with public works during the past few years; and second, the ever-increasing accumulation of evidence that advance planning and programming of public works can be practical.

You recall, of course, our total unpreparedness when the cataclysmic tide of depression rolled in full force upon us. We had been spending normally in the decade from 1921 to 1931 an average of well over ten billions of dollars annually for all types of construction work in the country. In 1933 that figure dropped to slightly more than three billion dollars. That tremendous curtailment of construction left a huge army of millions of workers, normally engaged in the construction trades and allied industries, stranded—cast out to join millions of others in the search for jobs that did not exist. You remember the futile attempts that were made to reemploy them by appeals to private industry. You remember the early efforts of the states and municipalities to handle the situation. But the collapse of municipal credit, partly due in turn to the collapse of real property values, forced the problem onto the federal government.

The Congress and the Executive immediately turned to public construction as a means of reemployment and stimulating recovery. Two established agencies of the government, one administering public roads funds, and the other dealing with the erection of federal buildings were selected to undertake an immediate expansion of their activities. At the same time, a Public Works Administration was created and entrusted with the task of expanding public construction through cooperation with federal and with local and municipal governments. Everyone did the best he could under emergency circumstances.

I think we have learned one lesson. Experience has taught us the importance of advance planning as a means of economic preparedness.

A great deal of skepticism, however, still exists with regard to the possibility of programming public works over a period of years. The efforts of Kalamazoo, Michigan (of which City Manager Clark has just spoken) and of Nashville, Tennessee, Winchester, Massachusetts, and other cities in which the National Resources Planning Board and the Federal Works Agency are helping, indicate, I think, that such skepticism is unwarranted.

Skepticism, however, plus expediency and opportunism have been in large part responsible for the traditional method of initiating and embarking upon public works at irregular intervals and in haphazard fashion. Yet, the advantages to be gained from approaching public improvements in an orderly way are apparent.

A works program that is the result of consideration and judgment is obviously likely to insure maximum benefit from the money spent. With a construction program scheduled for years in advance, it is possible for a municipality more or less to stabilize the personnel and operations of its various designing and construction bureaus. Preparations of survey plans and specifications can proceed with greater efficiency. Funds to finance and operate capital improvements can be organized more logically. Where the necessary authorization for projects depends upon popular referendum, advance planning permits the public to be informed and approval of the citizenry secured well ahead of time. It also offers the possibility of anticipating real estate requirements, making possible the purchase of sites at lower prices and to negotiate for lower materials and construction costs. It offers safeguards against pressure groups.

The principles involved in the advance planning of expenditures for construction work are not a new thing. Commerce and industry have applied them for many years. But private enterprise has, of course, always measured the returns to be expected from the investment in terms of dollars. Governmental agencies cannot always measure the value of public works projects by a monetary yardstick. For example, what dollar value could one place on a stream pollution project? Even though it is obvious that such a project is a health protective measure, that it has definite social and recreational value, and that it means a definite increase in property values which will ultimately show up in increased tax receipts to the community, the uninformed taxpayer may regard it as a luxury rather than a necessity.

Likewise, while it has been shown that slum clearance projects have a definite relationship to the curtailment of disease, crime, and fire hazards, all of which cost the public money, we have not yet discovered a formula by which to measure the monetary savings. Certain projects, such as toll bridges and water works are, of course, revenue-producing and provide economies and public services, but other projects which produce social benefits only can often be said to be of greater value to the community.

Despite the relatively large volume of emergency construction which has been undertaken in the past several years, our records indicate the needs of the people for vital public services have not yet been met. We are behind in school construction by about two and a half billion dollars. Over 100,000 obsolete one-room schools still cover the countryside; while almost 40 per cent of our educational buildings

are over 30 years old. They are obsolete and are in urgent need of replacement. Hundreds of small municipalities and unincorporated communities are still dependent upon the well and pump and rain barrel for their water supply. Streams bordering and flowing through some of the most important cities are polluted, endangering the health of the residents, lowering real property values and discouraging the location of new industry. Hospital facilities, in all but a very few metropolitan areas, are woefully inadequate. While notable progress has been made in the elimination of grade crossings on major highways, in the cities themselves, the problem is only now being undertaken on a comprehensive scale. The slum clearance carried forward in the last few years has barely scratched the surface.

During the boom decade of 1921–1931 all levels of government—federal, state and local—spent an average of two and eight-tenths billion dollars annually on public construction. Almost 90 per cent of this amount was made up of non-federal public works. During the past six years, we spent annually an average of three and one-tenth billion dollars—just a little more than we had spent in the Twenties, but *less than 46 per cent* of this amount was represented by *non*-federal outlays of funds. In other words, these figures indicate—and I say this without any intent to criticize—the federal government has been carrying the ball. But I think these figures further show that despite a substantial amount of expenditures for local public works, a great deal of needed construction remains to be undertaken.

There is enough work to be done in every community, in every county and in every state, to provide the basis for a tentative plan of programmed works for a long period of years. I do not think at this time it is necessary to deal with the method of selecting projects or the criteria for priority, or the manner in which to set up capital expenditures budgets.

I do, however, wish to call your attention to what may be an obvious fact, namely, that the actual programming of public works must be approached from at least two angles. One must first consider, of course, the urgency and the timeliness of the project itself, and the ability of the sponsor to finance it. But one must also relate the project to the realities of unemployment. The skills and experience of the unemployed workers must be taken into account in any local or state planning. Where an unduly high percentage of men normally employed in building construction are on the relief rolls, preference should be given to needed building projects; but where unskilled

and inexperienced workers predominate, projects of a different type must be chosen for immediate execution. Such discrimination does not mean the undertaking of useless projects. It only means that communities must take into account the availability of different skills.

Advance planning and programming of public works holds more than an academic interest for those of us entrusted with the administration of the Federal Works Agency. The consolidation of the major agencies of the federal government concerned with construction was carried out primarily with a view to increased efficiency in government administration, and consequently has a vital and definite interest in practical planning. With the activities of the Work Projects Administration, Public Works Administration, Public Roads Administration, the United States Housing Authority and the Public Buildings Administration—with which all of you are familiar through close personal contact—with all of these activities coordinated, the good relationship between the federal government and local governments should be further improved.

This relationship on the part of the F.W.A. extends beyond mere advisory capacity. It represents more than a medium for the simplified disbursement of tax moneys.

Think for a moment of how directly you, who may be municipal and state officials, deal with the federal government. Liberal grants of federal funds and of public lands have been made regularly to the states for purposes of education, agricultural experimentation, public health, forest fire protection, vocational rehabilitation, and other purposes.

Federal-state cooperation has grown even further in the last few years, but of greater import has been the tremendous development which has taken place with regard to direct federal cooperation with municipalities. Until recent years the Bureau of Reclamation, the Women's Bureau, Public Health Service, Forest Service—to name only a few of the many federal agencies which have rendered services in some form or other to municipalities—have assisted primarily through the furnishing of advice and data.

Now, however, Congress has permitted federal agencies also to provide *financial* assistance to municipalities. Some people have criticized this relationship as a breakdown of states' rights, but most of us know that this has simply been a natural by-product of changing economic conditions. After all it is all one nation and this kind of cooperation indicates high intelligence.

The activities of the Work Projects Administration and the Public Works Administration constitute the clearest example of this new type of federal-municipal relationship. Here on a scale never before attempted, the federal government entered into direct negotiations with cities and other local public bodies. As you know, the Work Projects Administration pays the cost of the labor, and in some cases even a share of the cost of the materials involved, in the construction of public works projects. The Public Works Administration makes loans and grants to states and local public bodies to aid in financing of useful public works which are initiated and carried through by local governments through the normal channels of private enterprise. You are all familiar with the extent of their activities, with the amount of funds that have been made available, with the employment that has been created and the type and quality of works that have been constructed. What I should like to point out, however, is that these two branches of the Federal Works Agency combine in their procedures the advantages of federal aid with complete independence on the part of local governmental units. The municipalities initiate the projects; they formulate the design; they determine the size, scope and location; and in the case of P.W.A. they let the construction contracts themselves. When a project is completed, it is the project of the local governmental unit, locally owned and locally operated.

The advantages of direct cooperation between the federal government and local public bodies have been clearly established. When slum clearance was first undertaken, projects were initiated and carried through entirely by the federal government. Now projects are undertaken by local authorities, the federal government limiting itself to financial assistance in the form of loans and subsidies.

You, who are city and state engineers, members of public works boards or otherwise vitally interested in the planning and programming of public works should recognize the value of the consolidation of all these agencies under the Federal Works Agency. The ways in which we are, and can be, of assistance to you is clear. You also can be of great assistance to us. After all, proper provision for the unemployed and the construction of vital services for the people are a joint venture which requires the best efforts on the part of all of us.

There are several ways in which you can help. With regard to W.P.A. I have already mentioned that you should give prior consideration to such work projects as will bear relationship to the number of unemployed and their skills. With regard to P.W.A. it has been

essential that all preliminary steps be disposed of so that when allotments are made, work on projects can begin with a minimum of delay. When the last P.W.A. program was launched a surprising number of communities presented applications for projects where advanced authorization had already been secured, plans and specifications had been completely drawn up, and arrangements had already been made for obtaining the local share of the cost of the project. Where communities were unable to do this, there was a tendency to blame the P.W.A. for the limitations and restrictions. We received a number of letters castigating us for unfairness, but the limitations, as you know, were placed in the law by the Congress. They were placed there for a definite reason. It is the business of those concerned to explain why they need more time. If their reasons are valid, Congress, I am sure, would change the law. The Congress is and always has been responsive to the will of the people.

With regard to slum clearance housing, I can only point out that despite the great success of the movement, there are still many large communities which have failed to set up housing authorities, even though the states in which they are located have enacted enabling legislation.

There are still some city officials who pretend to have not even the slightest concern about the architectural design or location of federal buildings within their municipalities. The Public Buildings Administration, however, wants the cooperation of all local officials and planners. It wants the advice of local communities with regard to building design and location of post offices, and other federal structures.

Planning is a broad problem. Occasionally variable factors arise which may require periodic revisions of long-term programming. There are such unpredictable elements as shifts in population, technological changes in industry, trends and methods of doing business, and the unforeseen effects of foreign wars.

Moreover, there is still unrestricted freedom on the part of entrepreneurs to move in where they like and to use the available resources and man power to their advantage; and then when it is no longer to their advantage to continue, they can move out without regard to the social consequences. The question is arising in many minds as to whether a community should be so shortsighted as to permit or encourage this kind of exploitation. A new industry, for example, moves into town, or an old industry makes an extension. It attracts artisans,

technicians, and workmen who are skilled in that particular type of work. The city suddenly feels a shortage in housing and unhealthy, short-lived real estate speculation follows.

But suddenly, the plant shuts down. It may be the plant was rendered useless because of a new invention. Or it may be that the owners have decided to locate elsewhere, because of a cheaper labor market. The workers are thrown out of their jobs. They default on their taxes. At the same time that municipal income is curtailed, the relief load is increased. The industry is not burdened with the consequences of its action but the city is left with a job on its hands.

In another case, an industry may locate in a section of the city where it can dump its wastes into the river with a minimum of expense. The public welcomes this industrial addition because it means more wages to be spent in the city, but homes all around the plant are covered by a pall of factory smoke. People sell their homes and move out. Property values fall. City tax collections decrease sharply. At the same time, the public bathing beach further downstream, which the city has built at great expense, has become unusable. City zoning, which is becoming more common, is preventing some of this, but the practice still prevails in too many places. Other types of wasteful exploitation need correction.

We treat such questions warily for we are terribly afraid of infringing upon the liberties of people regardless of the disastrous consequences that such unregulated freedom brings. There are simpler problems also which are impervious to attack because of this philosophic cloak. Take the question of the right of the automobile owner to park his automobile whenever and wherever he likes. I wonder if the time has not come to raise the question of the use of city streets for parking? Is it not possible to work out some scheme whereby systems of public and private garages could be built to take the automobiles off the streets and leave thoroughfares free for traffic? Public garages deserve serious consideration and it seems to me that here is a type of project that not only creates worth-while employment and permits the streets to be used for their proper purpose but at the same time constitutes a source of revenue which is capable of repaying the cost of construction. This is very properly a part of our total community planning.

Let us be realistic. Nothing will promote and encourage advance planning and programming of public works as much as ample demonstrations of its practicality.

DISCUSSION

HENRY M. WAITE
Washington, D. C.

THERE IS a lot of food for thought in Mr. Carmody's paper, as he touches both sides of the planning problem. For the first time we have a Federal Works Agency comprised of departments that are largely dependent upon intelligent planning. It is a great joy to see Mr. Carmody step out in front and lead the thought in that general direction. He not only looks at it from a federal viewpoint, but he looks at it also from the local viewpoint.

There is one thing to which I want to call your particular attention, and that is the selection of projects that will help, to the greatest extent, your local unemployment problem. We have not been doing this as thoroughly as we should. Locally we are selecting works projects for the W.P.A. people which require labor drawn largely from the ranks that are not unemployed. Mr. Carmody brings out very clearly that W.P.A. is an agency set up to look after unemployed people—and that we must draw from W.P.A. for projects and help, even as to the use of materials that will draw upon the unemployed locally. If you have brick, why use stone if it means you have to go outside of your own community? I imagine there is not one of you who hasn't had a large W.P.A. project for which you had to call in skilled labor and in some places go out of your own community for labor to finish the job. That isn't the theory of W.P.A., and I am glad that Mr. Carmody brought that out very clearly.

For a minute now I want to step over on the federal side. The federal government is thinking seriously, and quite seriously, in terms of six-year planning programs. I have been mixed up with two or three of them. It is a most difficult problem in the federal government to get departmental heads thinking in terms of long-range planning. Some of the larger departments do that but the departments that spend the greatest amount of federal money in construction work are terribly handicapped because they are always behind the gun in this planning. The federal government has never seen fit to give enough advance money for the engineering work, the early studies that should be made, particularly in a country that is spending as many millions a year as we are in public construction. Somebody will set up a project on the hill, legislatively, and keep the departments so busy checking

up and making estimates to keep up with the trend of Congress that they have no time or money to work out the projects, solve the drainage areas and so forth. As a result, the departments cannot say what particular thing should be done or should be done first.

Thus there are two factors needed in this federal planning: enough additional money for engineering and investigation and also long-range thinking by the departments, particularly the smaller departments who in the total spend a great deal of money.

Now we have heard a good deal about plans and programs. But as I see it, by thinking ahead in terms of planning and program and budgeting, you are educating your entire organization in such terms. You are getting rid of a great many of the practices of the past, the ruthless expenditures in trying to keep up with the Joneses. Ten or fifteen years ago Chambers of Commerce were trying to bring in all kinds of industry. We were building classy schools so that you would have a better school than Squedunk, to draw people to your community. We were going so fast that we never thought and never had time to think in terms of planning.

There are a great many difficulties in the careless use of the word "planning." A long time ago I used to think that the planner was a damn nuisance, that he interfered, that he was a highbrow. What did he know about where sewers should be built, or streets widened, or what have you? Now I have come to think that you practical fellows are half right and the planner is half right, but some way or other, between us, in what is facing this country in the future, the planner and the practical man, the administrator, have got to get together. Some planners will go so far as to say that you can't plan and you can't program until you get a city plan, which is all nonsense. As soon as you start to think in terms of planning and programming and budgeting, you will see the necessity of a city plan more than you do today and you will have fewer city plans laid on the shelf.

About 50 per cent of the planning commissions in the United States are zoning commissions and nothing else. Now why is this? Because the zoning problem is a pretty mean problem for anybody to tackle and the administrative heads are mighty glad to find a place to dump it, so they dump it on the planning commission and again your plan goes into the discard or into the trunk.

On the other hand—I am now talking from your side of the question again—I think the planning people, as such, are inclined to interfere too much on the administrative end. We have to get together.

In the federal government there is a central control through the budget for most of the public federal construction. This has been set up in the last few years, and gradually improved, so that now you have almost a perfect coordination between the Bureau of the Budget and the National Planning Board. The National Planning Board works out the details of the construction budget for the Bureau of the Budget. The Planning Board has the use of all of the experts that they have at their command and control. Particularly is that true of the Water Resources Committee, who have passed on all of the problems that have come up for construction on the federal budget.

But today, of course, the question of the federal budget is complicated by the stress of expenditures that we have been making for the last six or seven years, using emergency moneys. There are so many big projects started today that to reduce the budget means that you have to stop progress on some of these. It is a very difficult thing to set up a budget for six years because so many of the larger departments have to use considerable money. Of course, we are still further confused about what will happen to us in this country in the next four or five years. Which way is it going to go? But all in all, I think there is more intelligence being expended today in coordinating the various expenditures of the federal departments for construction.

Of course, our departments are growing very fast, due to the centralization of government in Washington, and that centralization will continue as long as the federal government is able to get the money and is not dependent, as you are, on your real estate taxes. You are more and more becoming dependent upon grants made by the federal government for every branch of your service. Not only from the federal government but from the state. What would you do today for your streets and highway repairs if it weren't for the gas taxes? That is a tax collected by your state government. However, after we have heard a paper like Mr. Carmody's I think we can't help but feel that Washington is thinking in terms of how it can, with the least possible friction, cooperate with you in your problems.

Loran D. Gayton

City Engineer, Chicago, Ill.

There is one thing that impressed me at the first part of Mr. Carmody's paper. He seemed to attempt at least to give the impression that very little planning has been carried out in the past. I

think the majority of municipal engineers will disagree with that. The trouble is we have been overloaded with plans. I don't want any of you here to steal this idea, but for some time I have had in mind the idea of collecting a lot of them and writing a book. At the present time some of them look funny, and the prophecies ridiculous. But there has been planning enough. The difficulty with most of us is carrying out those plans. You can make a 20-year plan but if you have a change of administration every four years your plan can be changed every four years. Ideas, policies, and available money change with every administration.

My experience has been more with the P.W.A. than with the W.P.A., and it has been very helpful. Figured roughly, we have accomplished about 3½ million dollars' worth of bridge work in the City of Chicago, with the help of the P.W.A., that would not have been carried out otherwise—all bridges that were all planned and that we have been trying to build for the last ten or fifteen years.

As you all know, we are carrying out in Chicago the initial section of a system of subways that will cost, I think, approximately 46 million dollars, of which the P.W.A. is giving 18 million. That great work would not have been initiated without the help of the P.W.A.

On the south side of Chicago we are well along on the construction of a large filtration plant. Filtration has been talked about in Chicago since the end of the Civil War and with the help of the P.W.A. we are now carrying out the first part of the program. The total cost of the plant will be approximately 20 million dollars and at the present time we are expected to carry out about 12 million dollars' worth of work by July 1, 1940. For this project the P.W.A. is giving us a grant of something over 5 million dollars.

As concerns the W.P.A., we have done a tremendous amount of work in the way of rehabilitation of the water supply system and a large amount of sewer work that was needed very much. Under the special assessment plan of building sewers in Chicago we would never have been able to carry out this work without the W.P.A.

One thing that is encouraging in Mr. Carmody's paper is that there is hope of an extension of time on these P.W.A. projects. In most of these large P.W.A. projects the time for completion is very short and it would be very helpful to all of us concerned with that work if an extension of time could be secured. I understand that Mr. Carmody is anxious to cooperate with municipalities in carrying out desired projects.

I think both the W.P.A. and P.W.A. are very much worth while, and our association with both of these agencies has been very helpful and cordial.

MR. GUY BROWN (St. Louis, Mo.): I have heard rumors that Chicago has been given until January, 1942, to complete the subway system. I would like to ask Mr. Gayton if that is correct.

MR. GAYTON: I believe that is correct, but I think Colonel Waite could verify that better than I could.

COLONEL WAITE: That is not true.

MR. BROWN: In other words, they are supposed to be through July 1, 1940, the same as any other project.

COLONEL WAITE: There hasn't been any change to date as to the completion of the subway. Chicago, by the grant agreement, had to do certain things. It had to have a franchise ordinance. They have had difficulty in completing the valuation of the transportation property, to make the new operating contract, and the time has been extended for the presentation of that ordinance to the administrators.

MR. BROWN: Of course, it wouldn't be possible to complete that subway by July, 1940.

COLONEL WAITE: You're telling me!

MR. BROWN: What is the problem? Will Chicago lose that grant after 1940?

COLONEL WAITE: I don't think so. I don't think Chicago realizes how much of the subway is already built. It is all underground and 68,000 feet of concrete is already built. All contracts for the tunnels have been let. I think probably they will be through on time. We have just advertised for bids for the first stations and that should be through about the sixth of next month.

MR. BROWN: My purpose in asking that question was that our P.W.A. authorities have insisted that they had no authority to make an extension beyond June 30, 1940. I was wondering by what process Chicago had received the extension, if that were true.

COLONEL WAITE: They haven't done that.

CHAIRMAN THOMPSON: Are there any other questions? If not, the Chair would like to ask one. I was under the impression that the P.W.A. had folded up and there was no more P.W.A. Is the door still open?

COLONEL WAITE: They are not folding up. They are cutting down.

CHAIRMAN THOMPSON: I mean are you receiving applications for P.W.A. projects?

COLONEL WAITE: No, none. P.W.A. has no money available for any of the projects that are sent in to Washington. Congress didn't give them any additional money and the law under which they are now constructing said the work had to start before January 1 of this year. So what small balances there are, and they are very little, cannot be applied to any new project.

CHAIRMAN THOMPSON: You may extend projects that are under way, may you not?

COLONEL WAITE: That might be possible, but it couldn't be a new project. I know Chicago decided that they wanted to use the shield method for subway tunnels downtown and it cost more money. Washington wouldn't give them any additional money by grant. They had to pay that additional expense with their own money.

MR. S. H. STRICKLAND (High Point, N. C.): If the project is held up legally in court, how about the extension of time?

COLONEL WAITE: I don't know whether they would extend the time or not. I am not aware if they have. I know that some things that are held up are canceled.

MR. L. H. ENSLOW (New York, N. Y.): Since the discussion has been largely around advanced planning, I would like to ask the Colonel whether it would be wise to do a little advance planning in the way of getting projects lined up and in order for P.W.A. application, whether the agency happened to be called P.W.A. or some other name? In other words, shall city authorities stop planning for federal aid works just because of this law, or shall we go ahead and plan and hope for something good?

COLONEL WAITE: That brings up a very interesting point. What do you plan for? Are you planning for your own communities or are you planning to get money out of the federal government? I think if we have been taught anything in the past few years it has been the necessity of forward thinking and planning. The whole idea of this effort of Mr. Sheidt's is to get experience from a variety of cities in setting up and budgeting a six-year program. That experience will be published in a manual which will be given to anybody in the United States who wants it.

Nobody can tell what the federal government is going to do. But I think that everybody in this room feels that this slump is not over yet and that we may have to have more expenditures. But all I say is for God's sake plan, and then if the federal government has to do something you will be that much better off. But for God's sake plan.

Mr. William S. Parker (Boston, Mass.): I should like to add this with regard to Boston. We have heard of the sample projects the committee is carrying out, to which Mr. Sheidt has referred. I happen to be chairman of the City Planning Board in Boston and I thought it would interest you if I reported that Mayor Tobin authorized us last year to proceed with a capital budget study for the city. We secured a W.P.A. white collar project for the work of plotting the background experience for the last twenty years, as a background on which to project for the future. Forms are going to the department heads this week, on which they are asked to report their own six-year programs and priorities as a basis for the general city program.

In conferring with the heads of four of the major construction departments in the city I have found none of the opposition that I had frankly expected to this six-year program, but a complete and ready acceptance that it was the only sensible thing to do and that they would have no difficulty in making their own best estimates for the next year and the succeeding five years.

I would like to add with regard to the last point the Colonel touched upon that it is a rule of the project and this study that we are leaving out of contemplation entirely the question of W.P.A. projects or federal grants-in-aid for P.W.A. projects. We are endeavoring to relate the needs of the city to the city's ability to pay for those needs. If grants-in-aid of one kind or another appear on the horizon, a six-year program will permit the city to take advantage of them and perhaps to advance some of the elements of the program more rapidly than would be possible otherwise.

Mr. Jean L. Vincenz (Fresno, Calif.): We certainly all agree with the idea of the six-year plan and the smoothing out of the expenditures over that length of time. It isn't always easy to get the finances. Two years ago the League of California Cities recognized that problem not only from the standpoint of trying to raise a million dollars in one year for a bridge, but that the problem of raising enough money to buy fire apparatus in a small city is almost as important, and in some smaller cities the purchase of a street sweeper presents difficulties. At the insistence of the legislature a law was passed under which it is possible to set up a capital expenditures fund to which moneys may be contributed for definite purposes over a period of years. Those purposes may be changed by the council during that time but money may not be taken from the fund and put back into the general budget for the purpose of making a big showing in tax reduction. This law

is a great help to the cities in financing projects or in purchasing necessary equipment over a period of years.

Mr. Harrison P. Eddy, Jr. (Boston, Mass.): Every time I get into a planning discussion I hear somebody say, as Mr. Gayton said, that plans are put in the closet and forgotten. I would like to rise to the defense of one type of planning which has been going on for forty or fifty years at least and is still respected and adhered to. That is the old comprehensive sewerage plans that have been prepared for years and years and which are still being conformed to. There are any number of cities in the country that dig out the old comprehensive plan and build to that from time to time as they need further extensions. Conditions change but the backbone of the plan, which is based on topography, is still usable many years afterwards.

Mr. P. L. Brockway (Wichita, Kan.): The expert from Boston expressed a sentiment that I always resent. I have heard it many times and I have heard it at this convention—the high-priest attitude toward the administrator. Why should the Boston Planning Commission be surprised when they go to the heads of administrative departments to find that they are thinking along planning lines? Why should Colonel Waite find it necessary to speak of "you fellows" and "we fellows?" Why is it assumed that an executive administrator, technical man or not, in public works is not interested in planning? I have heard that talk for years. I belonged to the old National Conference of City Planning, and I held membership in the American Institute of City Planning for some time. The thing that bothered me all the time was that city engineers and directors of public works are not supposed even to be competent to do anything about city planning. That question was brought up at one of the city planning conferences within the last year, and I know whereof I speak. It seems to me, actually, that the technical man who is responsible finally for getting this plan off the paper onto the ground has a more lively interest in planning than anyone else. If he doesn't think that the planning is the most important part and the ABC of the business he isn't what he ought to be and ought not to hold that administrative position. Now, I have that out of my system.

There is one other thing I should like to comment on in Colonel Waite's statement. That is about W.P.A. I have had exactly the conception of the intent of W.P.A. that he has announced—to set up projects which can use to the best advantage the men who need pay checks of some kind or another, to fit your own community's needs. In my

own community W.P.A. is composed almost exclusively of common labor, the commonest kind of common labor. But on one of the recent projects that I set up (and I know that other people have had the same experience) when we were intending to use common labor, wheelbarrow methods, if you please, we were turned down by W.P.A. because we did not intend to move dirt with heavy equipment and machinery which would not only cost the sponsor as much as his share of the W.P.A., but would give no pay checks to anybody. That bothered me a good deal. Why should the W.P.A. turn down projects especially designed to fit your own needs because you refused to do it at a total cost of less money and leave out these very people that W.P.A. was set up to help?

Preparing a Long-Range Program of Public Works

E. S. CLARK

City Manager, Kalamazoo, Mich.

MY REMARKS today concern the background and results of a study undertaken this summer to determine the practicability of advanced programming and budgeting of public works improvements. As you all know the city of Kalamazoo, since the adoption of the city manager form of government in 1918, has conducted its operations on strict budgetary procedure. The various departments of the city in the fall of the year submit their departmental budget for the coming year and from these estimates our budget is prepared. This budget is rigidly adhered to and in practice the department heads not only stay within that budget but endeavor to spend less than their estimates. This budget and the internal controls we have developed are designed to give our taxpayer the maximum in services for his tax dollar.

We have had as a primary objective the retirement of our bonded debt and since 1918 so handled our affairs that in the fall of 1937 we were able to retire the last of our direct debt and stand as the only city of 50,000 population or over in the country without bonded indebtedness.

Last May, Frank Herring, acting for the Public Works Committee

of the National Resources Planning Board, discussed with me the possibility of developing alongside our regular operating budget a budget for capital improvements. Could the general procedure followed for twenty years be broadly followed in developing such a budget, and could our desired public works be organized so that we could put on paper a reasonable figure of likely available funds and then schedule these projects in an order of desired priority?

There is little question in the minds of any of us as to the desirability of such a program if it can be worked out on a practical basis. Our civic improvements would be better conceived, more thoroughly thought out, and consideration would be given well in advance to methods of financing. When aid from outside sources became available we would have our schedule of improvements as desired by departments, we would feel that a considerable amount of thought had been given to many of them, and from this reservoir we could select projects with confidence in the knowledge that we were not pulling them out of a hat. In all, we thought that such a program was worthy of attention as part of our task of providing our citizens with a businesslike administration.

To assist in the collection and analysis of data, the National Resources Planning Board provided Robert N. Cross and George Newhall from the Public Works Administration who remained in Kalamazoo several weeks assembling material essential to the preparation of the report.

I believe that it would be of interest to you gentlemen if I were to review the steps in developing this program and some of the problems encountered in the work.

Our task fundamentally was the assembly of an inventory of desired improvement projects, the study of the background of our revenues and expenses as an aid in the determination of probably available funds, and finally the scheduling of desired projects in an order of priority and the allocation of projects to each of the next six years in relation to the annual amount of funds determined to be available for capital improvements. We would then have a six-year program, quite tentative of course in the later years, but at least down on paper where it could be revised annually in the light of changes as they developed.

The collection of the financial and engineering data proceeded simultaneously. Each department head reviewed its capital improvements and made an inventory of what we termed "wants." We did not limit ourselves to the tabulation of projects which could come only in the

six-year program but directed our effort to developing an inventory of needs as we now saw them, without giving consideration to whether they could be achieved during the initial six years of the program. Our purpose was to create a master inventory for a continuous program which would be definitely budgeted for a six-year period and revised each year.

This master inventory, as I have stated, was developed department by department, with each department indicating its order of project preference. After all departmental inventories were available, the master inventory was tabulated after devoting considerable thought to the establishment of priorities, using the departmental priorities as a guide.

Simultaneously with this work a review of revenues and disbursements was being prepared in such form that a six-year projection could be made. Revenues from 1920 to 1938 inclusive were classified by major sources and projected on the assumption that no change would be made in the current general property tax levy.

Disbursements for the same period were regrouped on a functional basis and also projected. In making the projections we reflected our desire to keep operating expenses at approximately current levels. The classification and tabulation of disbursements involved considerable work as it was felt desirable to segregate them into three major classifications: operating expense, equipment expenditures, and capital outlay.

Equipment expenditures, finally added as a total to operating expenses, was composed of expenditures for items of relatively short life and which for the city as a whole were recurring items of about the same annual amount. Purchases of typewriters, adding machines, fire hose, etc., were included in this group. The purchase of a fire truck, an item of long life, was considered capital outlay while police squad cars, which are replaced every 12 to 18 months, were classed as equipment expenditure items. This procedure was followed in order to develop a figure which would represent the annual recurring expenditures of the city.

Finally, through projections of revenues and operating expenditures, we determined the amount that should be available for capital improvements for each of the years 1940 to 1945 inclusive.

Having established the priority of projects, we drew up a schedule definitely allocating projects to each of the next six years in amounts to match the funds indicated to be available. This schedule was ar-

ranged so that the first year of the program represented a capital budget which we would rigidly adhere to, with the later years set up on a tentative basis to be changed as additional information makes logical a revision in present judgments. The six-year schedule is recognized as tentative, for not only are the estimates of revenue and operating expenses for future years subject to many variables but new needs will arise to lay claim to certain preferences which we now feel desirable.

Consequently, as part of the task of creating an effective program, we propose to establish a procedure for the annual review and revision of the schedule in the light of changes in need, desirability, and anticipated available funds. This annual revision is to be made not only from the standpoint of reclassifying and rearranging desired projects and adding to the list such new projects for which a need has arisen, but is for the purpose of maintaining as accurately as possible a reasonable forecast of revenues and disbursements. At the end of each year the program should be reviewed and, instead of then becoming a five-year program, the sixth year should be added and a tentative allocation of projects made to that year.

In conclusion may I read the last paragraphs of our study which summarize the advantages we anticipate from this approach to the capital improvement program.

Properly administered it will assure that projects are well conceived and properly financed. With some idea as to when projects may be constructed working plans can be prepared sufficiently in advance so as to minimize mistakes in detail affecting the adequacy and efficiency of the project so that its desirability and adequacy in our general plan will be more critically examined.

We will have developed a mechanism for the compact presentation and consideration of desired projects, and in the administration of city affairs this brief summary of desired projects and available funds can be modified or enlarged from time to time as conditions warrant and new needs appear. The programming of our desired public improvements and scheduling of anticipated funds should be of advantage in meeting the varying local conditions of unemployment and the annual reviews of this program and reclassification of projects and timing of construction might profitably be coordinated with local unemployment and relief needs. Properly administered, this program would contribute to city welfare not only as a tool for meeting local unemployment problems, but by having a definite program in mind economies would be obtained by taking advantage of changes in labor and material costs.

Fluctuations in the business cycle resulting in changes in the income and welfare of the individual citizen, movement of new industries into

our city, the trend of population and the results of studies of our suburban development, and the possibilities of an enlargement of the City corporate limits—all have an important bearing upon the problems of city administration.

An annual appraisal of these subjects will be helpful and, if a careful effort is made to put on paper the long term anticipated changes of city income and expense coupled with a review of capital improvement decisions made the previous year, we will be aided in our efforts to maintain the administration of city affairs on a realistic basis.

DISCUSSION

William Stanley Parker

Public Works Committee, National Resources Planning Board

As I read Mr. Clark's paper it struck me as being as direct and logical a description of the process of developing a six-year program for municipal expenditures as I had seen. I have only a few additional thoughts, therefore, by way of amplification and emphasis.

I think it worth noting that most of the work involved in the sort of study that was undertaken at Kalamazoo, and that has been completed or is still under way in a number of other municipalities, is not a recurring annual task. It consists of the analysis and ordering of the background statistics in such a way as to facilitate the annual programming operation. But once done, it is done for good and it provides a clear picture of the past, both as to operating expenses and capital expenditures and income, from which the trends can be studied and the future probabilities estimated.

Each year the entry of the experience of that year brings the background of experience up to its continually moving frontier. The addition of the new sixth year ahead completes the picture as far as the horizon that has been accepted as the useful limit of speculation. The process is simple and orderly and, by forcing us to relate our present situation to the facts of the past and the long-range view of the future, it tends to safeguard our current decisions each year. These decisions can be made with less confusion of mind and probably less expense of time.

Mr. Clark notes that in estimating future revenue, it was assumed that there would be no change in the current tax levy. This assumption is, of course, not necessary or desirable in all cases. In estimating income for six years ahead certain factors are matters of fact that can be appraised in the light of recent years. The trend in total assessed values

on which a tax can be levied can be fairly accurately gauged by the rate of population increase, business and industrial trends, and the relation of assessed values to actual values as indicated by current prices. Operating expenses can be quite closely estimated from past experience. The tax rate each year that would take care of operating expenses can, therefore, be quite closely estimated. Capital expenditures are less precise. Some items will be fairly definite while others will be far less so.

For purposes of forecasting a six-year program, two methods can be used. In one, you can make your best decisions as to capital expenditures, which may well vary quite widely from year to year, and then work out the tax rate for each year that will be required to provide the total funds needed, including both operating and capital expenditures. In such a procedure you will probably develop a series of variable tax rates according to the variations in capital expenditures. Psychologically this result would probably be unfortunate.

The other way would be to assume a desirable tax rate first. This might be a level tax rate, or it might be a gradually decreasing or increasing tax rate according to the financial and other conditions of the municipality involved. On such an assumption the total yield will be shown, and the difference between this yield, each year, and the estimated operating expenses will show the amount available for capital expenditures, which can then be studied in relation to the degree of need in each project and their adjustability, in time of starting, so as to fit most effectively into the limit of funds available year by year.

I have stressed this point because some assumption has to be made and sometimes an assumption of the level tax rate is criticized and misunderstood. As a matter of fact the study each year will probably proceed on a trial-and-error basis until, as finally approved, it seems to meet best the capital requirements and the ability to pay.

A confusing factor in these first studies has been the question of deciding just which maintenance items shall be called operating expenses and which shall be called capital expenditures. I think the studies are rapidly developing a workable standard rule that can apply in all cases. But it will probably be an expedient rule rather than a rule based on some broad logic. Some have held that recurring expenses are to be called operating, nonrecurring to be looked upon as capital. This doesn't seem quite adequate. In a growing community various elements of capital improvement are a normal recurring annual item.

New schools, new sewers, new streets become recurring items in a rapidly growing city, but they would hardly be placed in the list of operating expenses. An annual operating item for automobiles might be, while heavy trucks and fire apparatus might not be. So this decision, which has faced each of these experimental studies, will probably be made on a basis of practicability rather than broad principle, but in a way that will be adaptable to all types of communities.

It has been encouraging to me to see the way in which, as these studies proceed, the various department heads come to realize the reasonableness and simplicity of the programming method and the indication of a readiness on the part of the controlling officials to agree to its adoption as an annual procedure. It can become a powerful means to the improvement of our municipal finances and the stabilizing of municipal expenditures with broadly diffused benefits to the national economy.

LAWRENCE V. SHERIDAN

Regional Councilor, National Resources Planning Board, Cincinnati, Ohio

I WAS interested in visiting Kalamazoo and observing at first hand how that city is operated and the attention which they habitually give to programming. Because it is a regular part of their activities, it was easy for Kalamazoo to undertake the preparation of a six-year public works program.

The various habits of government in Kalamazoo all contributed to the working out of this six-year program. In the first place the activities of the various department heads are continually coordinated. The city has a considerable background of public works experience, as is evidenced, of course, by the fact that they were able to eliminate all of their bonded indebtedness. Unquestionably, much attention had to be given to the business of running the city in order to be able to do that, and there also had to be very close cooperation on the part of the public.

The basic planning they have done in Kalamazoo also contributed to the working out of this program. Several years ago, through the agency of a city plan commission, a basic plan was prepared which covered all features of city development. I know that that plan is used for the maps are hanging on the wall where they can be seen—not gathering dust as is the case in some cities with which I am familiar.

Some time ago when we were discussing the working out of a long-term public works program for cities, a good many people with whom we talked seemed to think it was a large and very difficult task. It occurred to some of us that if each city would take its past experience, back ten years or even twenty years, and set up the actual program that it had already carried out, it would find that it had already done many of the things that are desirable in setting up a program projected into the future. As a matter of fact, every city operates on some kind of a public works program, and has encountered certain difficulties. It has had to adjust its tax plan to its works plan; it has had a great deal of contact with the public; there has been much educational work to carry on, and so forth. And if that past experience can be set up and visualized as a program, the gaps can clearly be seen, the mistakes which were made can be seen, and that experience can be used to advantage in setting up the six-year advance program of public works. Then, each year that a revision is made of the six-year program and it is projected one more year into the future, the experience and the methods become more clear, and by the time the first six-year program has elapsed and another is ahead, such planning will probably be a habitual method of operation within the city and one that will be understood thoroughly by the public.

I think it cannot be emphasized too strongly that long-term planning plays a very essential role in public works programming. It is practically impossible to develop a workable six-year public works program unless there is a definite plan upon which it can be based. That plan must include, first of all, an understanding of the objectives of the city itself, what it intends to become or what it means to continue to be, and the directions in which its greatest opportunities lie. Then if the plan is worked out to show construction immediately essential, the program can be set up to accomplish those things which need doing now or in the near future, and can also give consideration to those elements that lie beyond the limits of the program being worked out.

Furthermore, to develop a plan and a public works program—and to tell the public about it—will contribute to a better public understanding of the objectives of such a plan and program. The very fact that the public realizes that the city government is looking ahead will bring greater public support. Conversely, it will provide an opportunity for those responsible for the program to find out what the people generally want to have done.

Now just a few words about the extent of public works programming. As you know, a federal public works program is being developed, in which many people are cooperating. For instance, the drainage basin committees, set up throughout the country to study the use and control of water resources, were recently asked to review all of the water projects in the federal program. While there were some faulty spots in that review, it was a first step toward obtaining a much better view of such projects. The same is true of other elements of the plan.

The state planning boards, with which many of you are familiar, are nearly all charged with the development of a state works program. Not many of them have done it very extensively yet, but many have taken the first steps and will undoubtedly go further as their plans progress and they understand more clearly the need for such a program. It involves, of course, the further coordination of all the different state activities and that is a big problem in itself.

Many states have county planning statutes, which nearly all charge the county with developing a public works program. The same is true with cities, although not many of them have done a great deal as yet. The demonstration plans which have been set up at various points throughout the country, of which this Kalamazoo plan is one, will do a great deal to point out how cities can effectively and profitably proceed on long-term public work programs. I believe that most cities will be glad to learn more about how these programs were worked out.

Chairman Thompson: We have an unexpected added attraction. I have been informed that Mr. Melvin Scheidt, of the National Planning Board staff, is here. Mr. Scheidt has been swinging around the country setting up four additional projects like that in Kalamazoo. I am going to ask him if he will make a few remarks on this subject.

Mr. Melvin Scheidt (Washington, D. C.): Public works in municipalities have been approved in the past largely from two points of view. In a great many cities in the past they have been undertaken piecemeal, a project considered this month, worried through the council, and finally funds appropriated for it. Two months later there is another one, perhaps a month later two more, and so on, in a rather haphazard and irregular fashion. The projects are not related to each other nor to the direction in which the city is to go.

In an attempt to arrive at some sort of pattern for the development of a city, the custom came into being some years ago of developing

long-range city plans. We heard here of a ten-year plan and elsewhere of a five-year plan. I have even heard of seventy-five-year plans. When you check up on them, you find, "Oh, yes, we had a plan. George, where is that thing? Oh, it is in the cupboard somewhere. I don't know." That is about where most of the long-range plans of the fixed kind usually end up. The first year there is an appropriation, the second year there is one, perhaps. The third year the administration changes and the fourth year the plan gathers dust. By the time the ten years are up, the plan itself has been forgotten, or circumstances in the town have changed so that that plan is rendered totally useless.

In an attempt to arrive at some sort of compromise, recognizing that cities do build public works—they may not have plans but they still have to build—and at the same time trying to provide some sort of flexible procedure which will take into account the fact that cities change from year to year, the idea of the moving long-range public works program was developed. It is this for which we are trying to work out the mechanics through our experiments. As the program is developed, it may cover six years, but there is in that process the provision for reviewing that program annually, both as to financing and as to the public works improvements the city should build. Thus, although you schedule the works that you propose to build over six years, an emergency occurring this year need not disrupt your program because next year you would review that program anyway.

The principal thing that we are working on now in our experiments is the mechanics of the organization, the internal structure in the various kinds of cities in which programming must be carried on. You recognize, of course, that there are many kinds of municipal structures and that the same type of internal organization and operation wouldn't apply in all of them. So the National Resources Committee, through the Public Works Committee, is now carrying on seven demonstration projects, or demonstration studies, I should call them, to determine what sort of internal structure or method of operation is adaptable for these different kinds of cities. We have already completed a study in Winchester, Massachusetts, a small suburban town, one in Nashville, Tennessee, a southern industrial city of approximately 200,000 people, one in Kalamazoo of which you have already heard this morning, others in Dallas, Texas, Fargo, North Dakota, Spokane, Washington, and Sacramento, California. Out of these we hope to arrive at an understanding of the various ways in which this procedure can be carried on.

I should like to leave with you, as one thing I learned on the trip I have just completed, a thought on the value of these experiments, besides that of providing perspective as to where the city is going to go. This is from the wisdom of several city managers to whom I have talked. They said, "This kind of a program is the most valuable thing we can get to offset pressure groups." In fact, in one of the cities that I visited they said, "We wouldn't have had a program of this kind had it not been for the pressures upon the council and upon the city manager from local neighborhoods, each trying to get the hog's share of the funds available and no authoritative program or plan which could be used to offset their pressures or their demands." That, I think, is of considerable value in this kind of programming.

Pittsburgh's Public Works Activities and Their Organization

Frank M. Roessing

Director of Public Works, Pittsburgh, Pa.

The metropolitan district of Pittsburgh presents one of the nation's greatest challenges to the public works engineer and to the city planner.

The Pittsburgh Department of Public Works, which I have the honor to administer, is a catch-all department. We combine the problems of construction with the problems of maintenance; we combine such unrelated functions as the supervision of parks and playgrounds and the collection of garbage and the cleaning of streets.

Organization of the Department

The department is headed by a director, responsible only to the mayor. Under the director, the department is divided into bureaus, each with a superintendent. These bureaus include a Bureau of Engineering, which in general performs all the engineering functions for all other bureaus in the department and in addition has direct supervision of surveys, of street lighting, and bridges and structures. (It is an interesting proof of Pittsburgh's unusual topography that we have more than 125 bridges to look after, in addition to those

maintained by the county government.) The Bureau of Engineering also controls the letting of all construction contracts for the department and the inspection of performance thereon.

The Bureau of Water maintains our water supply system. Pittsburgh draws its water from the Allegheny River at the nearby suburb of Aspinwall, where it is filtered by slow sand filtration and chlorinated. A reservoir and pumping system sends it through approximately 900 miles of water mains to delivery at the tap.

The Bureau of Highways and Sewers is charged with the cleaning and general maintenance of 1,350 miles of streets and alleys, of which more than 900 miles are paved. We have 950 miles of sanitary and storm sewers with 22,000 catch basins. This bureau also has charge of one of Pittsburgh's unusual public works features, the maintenance of 40 miles of boardwalks and steps which climb between our hillside streets. It maintains an asphalt plant whose product is used for patching and resurfacing, and a garage for the servicing of its street sweeping and repair equipment.

Pittsburgh's 1,869 acres of park area are maintained by the Bureau of Parks, which also has jurisdiction over the Phipps Conservatory, the Highland Park Zoo, and the planting of shade trees throughout the city.

Our playgrounds and swimming pools are operated and maintained by a Bureau of Recreation, which also stages pageants, operettas, and other spectacles for the entertainment of the citizens. We are presently in the process of organizing a system for the municipal collection of garbage, rubbish, and ashes and for their disposal in a municipal incinerator in the case of garbage and rubbish, and in a city-owned dump in the case of ashes. We have previously been the prisoners of a private garbage-collecting monopoly, and we never before made any arrangements whatsoever for the collection of domestic ashes.

Finally, the department has a Bureau of Tests which operates not only for materials purchased by us, but tests materials for the entire city, and for contracts let by city departments. In addition, we have a Division of Accounting and one of Photography.

Our budget for the regular operation of the department has averaged at about $5,500,000 in recent years. I am sure that we are in no respect different from any other works department in the land in our feeling that it is not enough by a long sight.

The County of Allegheny has its own works department which

has certain jurisdictions in the city, and the state highways department maintains the much too small percentage of our streets which have been declared state roads. School properties are maintained by the Board of Education, which is a tax-levying body separate from the city government.

The outline I have given you constitutes the regular, ordinary, year-in, year-out, pattern of our Public Works Department.

But these are not regular, ordinary, year-in, year-out, times in Pittsburgh. This city is having its face lifted in the greatest program of public works which has ever been undertaken in the district.

Necessity for an Expanding Program

I believe, and I think the facts will bear me out, that the cities of America are today awaking to the fact that they must adjust themselves to the technical changes which have arisen in our life or else die of economic strangulation.

We know now that the streets which were planned a half-century ago, and the highways which were built as farm-to-market roads, cannot cope with the traffic conditions of the present. Our people are getting tired of the nerve-racking delays of traffic congestion; our people are tired of the toll of death which poorly planned streets and highways exact; our people want road freedom in which to exercise the wonderful technical advantages of the modern automobile. It was no accident that the General Motors exhibit, depicting the highway traffic of the future, was the smash hit of the New York World's Fair.

And we know now that the slum housing which afflicts our cities, spreads blight, destroys values, drains municipal funds, and breeds men and women without hope and with a grudge against society, is an evil which must be overcome if our cities are to continue as the citadels of democratic government.

We know now that man does not live by bread alone. We know that we must provide parks and playgrounds, breathing spaces of green and open lands, in the midst of our crowded cities if our citizens are to be happy in mind and spirit.

We know that it is a crime to make watery deserts of our streams and rivers by polluting them with the wastes of municipalities and of industries. We know that the ravages of floods can be overcome by the expenditure of less money than the floods take from us in the havoc which they wreak on our low-lying communities.

We know that water—pure unpolluted water—is a raw material

which is as important a source of wealth as coal or iron or natural gas, and that it is the duty of our cities to supply it if they expect to prosper.

And the majority of us realize, I think, that the unemployment of men, when these things remain to be done, is an economic waste equal to the waste of idle lands or idle factories. It is an ironic thing that there should be those among us who cheer the employment of men in war industries as a natural and normal boost to prosperity, and yet make the welkin ring with their lamentations when the government uses its credit to employ men to build houses, and schools, and hospitals.

No one should cavil in these desperate times at any expenditures which the government should make to insure the national defense, but does not the national defense embrace the defense of our living standards and of our peoples' happiness?

Today our city and its environs are stirring, as never before, to meet the needs of a new era in municipal life. We are not only trying to build for the future, but we are atoning for the past, when depression budgets took a terrific toll from the city's physical plant, and when the vagaries of a city administration, now happily gone these three years, rejected all federal funds as having the sulphury taint of Satan.

In cooperation with the federal Public Works Administration, the Pittsburgh Department of Public Works has direct responsibility for a $12,717,000 program of improvements to our sewer, water distribution, street, bridge, park and playground systems. Through this program we are taking up the slack of maintenance failure, and we are going ahead to build for the future. The city share of this program is being provided from an $8,000,000 bond issue, laid before the electorate last summer by the mayor and ably championed by him, and approved by a large majority of the voters.

A major portion of this program is the installation of four great drainage systems, replacing sewers which were inadequate to serve populations which had doubled and redoubled since they were laid. Our topography necessitates the placement of some sections of our sewerage system at depths of from 13 to 140 feet, which, of course, requires a good deal of tunneling. In a major drainage basin on our North Side, one of our sewers is tunneled for 1,170 feet at depths ranging from 17 to 140 feet and this is duplicated, in greater or less degree, in our other drainage basins.

All of our new sewer construction is of terra cotta tile pipe, brick,

reinforced concrete pipe, and reinforced concrete sewering encased in monolithic concrete where there is great stress, as beneath a railroad right-of-way. We believe that we are building our sewers large enough to take care of any reasonable future increase in population and building in the areas they serve.

We are repaving, and in some cases widening, approximately forty streets in our bond issue P.W.A. program. This is almost purely a maintenance job which should have been done from year to year. It by no means answers our street repaving needs. We are surfacing our streets with brick, concrete, asphalt, or stone paving block depending on the grade of the street and the amount of traffic it must be expected to bear.

The water distribution system is receiving, under our P.W.A. program, a reconstruction of important mains, which again is a maintenance activity which should have been carried on from year to year. Our most important water line, the rising main from the initial pumping station to the main reservoir, was more than sixty years old, and this, I would remind you, was the very jugular vein of the city's water supply. We have also added a number of new storage tanks which will insure a reserve water supply and a better summer pressure in the higher areas of the city.

Our playgrounds for the first time are getting real attention through the city-P.W.A. program. We are constructing four new all-year-around recreation centers in congested areas where the home play space of our children and young people is most limited. One such center will replace a condemned house, another an abandoned stable, as the recreation centers of important playgrounds. In addition, we are constructing four new swimming pools, several bathhouses for pools already in existence, nearly a score of field houses, and we have installed filter and circulating systems in every city pool, this latter eliminating a shameful menace to the health of our young people.

Park roadways are being repaved or reconstructed, and the Highland Park Zoo, which six years ago was so disgracefully run down that the Humane Society threatened proceedings to close it, is being remodeled into a thoroughly respectable institution which is attracting greater and greater crowds. If you will pardon an aside, I should like at this point to remind you that a large city with a large trade area to cultivate makes a wise investment in such public institutions as zoos, conservatories, and museums, for they attract thousands of out-of-town visitors. And when you have a man and his family come

to you for recreation, it is natural that they will come again when they have money to spend with your merchants.

Essentially, our city, with the aid of the federal government, is putting its municipal house in order to the extent that twelve million dollars will do it.

And we have discovered this interesting fact: that more than 50 per cent of the city's share of the cost of these improvements goes right back to our citizens in the form of wages paid by the contractors. On three typical projects, a street job, a bridge job, and a water main reinforcement, the city's share of the cost was approximately $140,000. Manual labor on the jobs received $77,451 in wages, Undoubtedly enough of the materials used were produced locally to return to Pittsburgh workmen the entire city cost of the projects.

But setting our house in some kind of order is not enough. There is a great portion of our municipal dwelling which we have outgrown, and which we must rebuild.

Construction to Meet Traffic Needs

One of the factors which is forcing us to rebuild is traffic. As the tie-ups in traffic bottlenecks increase in intensity, so does the pressure increase on the governmental authorities to do something about it. With returning prosperity, and increasing traffic following in its wake, we may expect the intensity of pressure to increase.

The city is acting directly to remove one bottleneck through the construction of a new bridge from the Boulevard of the Allies into Schenley Park. Here, at the cost of approximately $800,000, a four-lane bridge with a separating approach on its far side will deliver traffic from the heavily traveled six-lane boulevard where traffic now chokes up on a narrow two-lane bridge. This also is a city-bond-issue-P.W.A. project.

Bigelow Boulevard, our main traffic artery to the east, is being modernized through the cooperation of city, county, state, and federal governments. This boulevard is a state highway, and the state government is paying the physical cost of the improvement, using federal Bureau of Public Roads funds to defray a part of its expense. The city is standing property damages, and paying for the relocation of water lines and sewers, sidewalks, walls, and fences. The county will pay property damages for the area where the boulevard enters the Triangle because this portion of the improvement will connect with the proposed cross-town boulevard, a county project.

The original Bigelow Boulevard was a 40-foot roadway with asphalt pavement and an average daily vehicular traffic count amounting to 26,000 vehicles. It was constructed out of the side of a hill, and the rock slides which took place are historic in Pittsburgh. It is told that General Goethals was brought here at a fee of $1,000 a day to tell the city how to solve its slide problem, and that he received his fee for just three words of advice, "Let 'er slide."

The final results of those slides were not apparent to this city until just a few months ago when the Supreme Court of Pennsylvania awarded a judgment of approximately $800,000 to the Pennsylvania railroad for damages allegedly suffered in those slides of twenty-five years ago.

The new boulevard will have four 12-foot traffic lanes, with a continuous 4-foot center divisor, and a 6-foot sidewalk with 4,400 lineal feet of iron fence. Two dangerous curves in the old boulevard will be taken out by means of cuts which will entail the removal of 512,000 cubic yards of excavation. The estimated cost of the physical work on the 2.07 miles of the upper boulevard is $1,052,000 and property damage will be $310,000.

This section of the boulevard will be completed this year and the boulevard will remain open while state, city, and county cooperate next year to build a clover-leaf traffic separator where the boulevard enters the Golden Triangle of downtown Pittsburgh. The preliminary estimate of the cost of this improvement is $1,500,000, a major portion of which is for property damage.

Along the banks of the Monongahela River, county, city, and federal funds are being used on the first lap of a waterfront and cross-town boulevard, which, when completed, will comprise a circumferential boulevard around the Triangle area—a boulevard which will be a traffic separator on a grand scale, making it possible for traffic bound from one residential section of the city to another to proceed without adding to the Triangle shopping and business traffic.

This waterfront boulevard now in construction has a roadway improvement width of 150 feet, and beyond the roadway the wharf will extend to the water line, providing parking space for automobiles and dock facilities for river boat service.

The improvement repaves the present Water Street for local traffic and provides two 30-foot separated high-level roadways for east- and west-bound traffic, a 40-foot low-level roadway along the wharf level, and connecting ramps between the two roadway levels. As might be

expected along a sandy river front, extensive retaining wall construction is included in the improvement as well as concrete piling and foundations. The cost of this improvement is estimated at $2,759,000.

We hope and believe that the county will be able next year to undertake a similar construction along the Allegheny waterfront, and a cross-town boulevard will then be built to connect the two waterfront roadways.

These traffic improvements represent an important start in the job of making our city easy of access and of protecting property values in the Triangle, which is the major tax-producing section of the city. At the present time, further improvements are being charted in a planning study directed by Robert Moses, New York Park Commissioner, whose staff was engaged by the Pittsburgh Regional Planning Association, a private agency, to make a study which will either confirm the judgments of our own City Planning Commission or else develop new thoughts in planning for the future of Pittsburgh.

Homes Instead of Slums

Pittsburgh is presently attacking the problem of slum clearance and low cost housing. The Pittsburgh Housing Authority, whose members are appointed by the Mayor, is now engaged in an $18,500,000 program and the first of its dwellings will be ready for occupancy in March, 1940. The Housing Authority has under construction more than 3,000 dwelling units which will rent for no more than $4 a month per room.

Nathan Straus, Administrator of the U. S. Housing Authority, has called our projects "the most dramatic housing projects in the country." More than 400 houses are included in the first project, Bedford Dwellings, where on October 11, John Carmody, head of the Federal Works Agency, will lay the cornerstone in the administration building. The walls of the houses are already rising on this site. The second and third housing units are the dramatic ones. They are being built where three barren eroded hills, with a few scattered and cheaply constructed houses perched upon them, have stood since Pittsburgh was founded, forming a great barrier between the downtown and hill districts and residential Oakland and Schenley Heights.

More than 3,000,000 cubic yards of earth will be cut out of these hills and filled into the Soho ravine which separates them. On the filled-in ravine, a 12-acre playground and park will be laid out, and on the terraces of Goat, Gazzam, and Ruch Hills, some 2,700 families,

now paying exorbitant rents for miserable housing, will find sunlit, healthy, low-cost homes.

The City Department of Public Works is doing the testing for this construction and is installing sewers and water lines and is paving the new streets. By utilizing W.P.A. labor we have materially lowered the cost to the city of the latter work. All branches of the city government are confident that the removal of blight through the erection of the new housing will compensate the city for the loss of tax revenues from the areas occupied by the housing projects.

The City Health Department, with aid from us in the nature of testing and inspection, is erecting a new $1,900,000 municipal hospital for the treatment of contagious disease, replacing an old firetrap structure which long since outlived its usefulness. This is a P.W.A. project, as is the same department's reconstruction at Leech Farm tuberculosis sanatorium, which will provide space for 160 more patients at a cost of about $700,000.

We are directly supervising the construction of a 600-ton incinerator, now rising in our Lawrenceville district. This will, we believe, together with the municipal collection of garbage, save us over the cost of private contract collection a sum large enough to pay for ash collection and $200,000 annually in addition.

You, perhaps, see by this time why I said that this was no ordinary, routine, average public works year in Pittsburgh. Directly and indirectly, the municipal Department of Public Works, this year and next year, will be concerned with the expenditure of $39,000,000 for contract construction in our city. This is more than $55 for every man, woman, and child in the community. And practically all of this work is being done under the speed requirements of federal grants.

But the end is not yet in sight for public works in the Pittsburgh district. We have continuously sponsored a large W.P.A. program, and the quality and efficiency of W.P.A. work have steadily improved. We have hard-surfaced 50 miles of dirt streets and have laid more than 60 miles of new water lines with W.P.A. labor. W.P.A. work has been of exceptional value in our parks and playgrounds. Tennis courts, park trails, stone steps and fences, playground drainage, shelter houses, and similar improvements have added immensely to our recreational and park plants. W.P.A. work transformed the Phipps Conservatory in Schenley Park into a show-place which we believe is one of the nation's finest, and at the Highland Park Zoo, the open stone-work bear dens built by W.P.A. will match any in the country.

Generally speaking, we have found that W.P.A. has been as good as its supervision and that where time is not of the essence, it is often more satisfactory than contract work because plans can be changed as the improvement progresses without piling up contractors' extras.

The city has spent more than $3,000,000 for W.P.A. sponsorships since the program began, and we believe that we have got far more than our money's worth in the improvements we have gained. Old water lines, so encrusted by scale as to reduce pressure to the vanishing point, have been replaced at considerably less than the estimated cost of contract construction—and such work as this was no luxury; it would have been necessary if W.P.A. had never been heard of.

Two other great public works projects are in progress in our metropolitan area, and both of them are of great concern to Pittsburgh.

One of these is the all-weather highway from Irwin, a point about ten miles from Pittsburgh, to Harrisburg—the so-called "dream highway." This all-weather highway is being constructed by the Pennsylvania Turnpike Commission, created in the administration of former Governor George H. Earle, and the P.W.A. is paying 45 per cent of its estimated $60,000,000 construction cost.

The highway crosses our rugged Allegheny mountains with no grade of more than 3 per cent. Utilizing the old right-of-way of a railroad planned to compete with the Pennsylvania, which was never completed, it utilizes also seven mountain tunnels originally built for the railroad. It will be separated and will have the absolute minimum of intersections. There will be no maximum speed limit on this highway. Tolls paid by motorists using the road will, it is planned, liquidate the indebtedness of the Turnpike Commission, which financed its share of the cost largely through the R.F.C.

The second great construction project in this district, outside of Pittsburgh, is the federal flood reservoir program which is being carried out by U. S. Army Engineers. Some of you may remember that we had quite a flood here in 1936. You can bet a thousand to one that it will never happen again. Since that time the great Tygart River dam has been completed on the headwaters of the Monongahela River; dams on the Tionesta and Crooked Creek tributaries of the Allegheny are in mid-construction; and bids have recently been received and work has started on two other projects of the ten-reservoir plan above Pittsburgh. These dams and reservoirs will cut the maximum possible flood crest at Pittsburgh by 11 feet. The dams already in progress will alone almost eliminate the danger of such a flood as we had in 1936.

Projects Still to Be Undertaken

Talking of water leads us to the two great public construction programs which are looming up more and more as the next great tasks for our city to tackle. One of these is the problem of sewage disposal. Pittsburgh is admittedly one of the worst offenders in the Ohio River Valley. We pour our sewage untreated into the rivers upon which millions of people depend for drinking water, and we drink water polluted by those who live above us on the rivers.

The problem of sewage disposal is still in the study and survey stage here, and a primary cause of this condition is the difficulty of bringing about joint action among the more than 130 separate municipalities which are located in Allegheny County, our natural sewage disposal and sanitary district.

Through the W.P.A., a survey has been completed which looks to the installation of a system of intercepting sewers and a number of treatment plants to serve the 1,500,000 inhabitants of Allegheny County. The estimated cost of this system is $36,000,000 and it is proposed that an authority undertake the work, its bonds to be retired through proportionate payments by the municipalities affected—their funds to come presumably from a sewer assessment. The mayor has very recently called on industry to develop a similar survey of stream pollution by industrial wastes.

We are not very hopeful of real success in cleaning up our rivers, however, until federal action is taken in this field, both through a federal law punishing pollution and federal grants aiding in its cure. It was disappointing that the Barkley bill, aiming at these objectives, died in the closing hours of the last Congress.

State action has proved impotent in Pennsylvania, with the present administration apparently divided against itself on the problem. On one hand the state department of health chided us for our slowness in ending pollution of the rivers. But on the other hand it gives industrial polluters a free hand in despoiling our streams.

Just a week ago, I went on an inspection trip to the Clarion River, one of the principal tributaries of the Allegheny—our water source. The Clarion flows through beautiful forest country, the prime hunting country of Pennsylvania, and through Cook Forest Park, the last stand of virgin white pine left in the state. It should be a clear stream filled with fish. Instead it is an inky black open sewer, covered with a froth of paper mill waste, stained with chemical paper wastes and

tannery drainage. Two tanneries and a paper mill destroy this stream and pollute the drinking water of two million people. They do it in brazen violation of the law of the state—and the state does nothing.

The state has also countenanced the pumping of acid mine wastes from flooded mines in other tributaries of the Allegheny on the specious plea that the mines would be reopened and jobs provided. The only jobs provided so far have been in the soda ash factories which make the neutralizer which we must dump into the water to make it fit for use. And the State of Pennsylvania is a lone holdout from the Ohio Valley Compact for the purification of tributaries to that great and once beautiful river.

Even when our streams are purified, we will find that pumping our water from the Allegheny River will be a costly, uncertain process, which will not deliver a top quality water for industrial and domestic use. The Mayor of Pittsburgh has taken the initiative in searching for a new source of water for the city—a source that would be flood-proof and drought-proof, that would deliver water by gravity, that would deliver water in enormous quantity, and that would deliver a soft water from glacial beds, as pure as any naturally occurring water can be.

We believe that in a system of reservoirs leading from the northwestern end of the state to Pittsburgh we have found a supply which can deliver 500,000,000 gallons per day by gravity of the type of water which we need for industrial development. It is the mayor's belief that the assurance of such a water supply would so lower the cost of manufacturing in the district that our industrial area would gain a competitive factor in the nation-wide contest for industrial locations.

The system is estimated to cost approximately $75,000,000. It is proposed as a self-liquidating project which would pay out from the sale of the abundant surplus to neighboring communities and water companies. A New York bond house has proposed to our city council that it will undertake all responsibility for preliminary engineering on this project, and that if the engineering proves it feasible the banking house will undertake the sale of the necessary bonds, which the city has legislative authority to issue without adding to its constitutional debt.

Importance of Federal Aid

So you see that this is truly an unusual period of public works development in the Pittsburgh area—that Pittsburgh is really having its

face lifted. And perhaps you have noticed the common bond which unites practically all of the huge program now in construction—the common bond of federal aid. Without federal assistance, it is very doubtful that any major portion of these things would have come into being. The federal government has truly come to the aid of the cities of America in their hour of need.

Economic depression has contributed to the cities' dependence on federal assistance, but there is a deeper underlying cause, and that is the subservience of the cities to the states. The states of America are the guardians of the cities, and they are guardians who, it has been aptly said, have refused to function. Our cities do not have the necessary freedom of action, the true home rule, needed if they are to meet the demands put upon them by this technical civilization of ours.

I have talked much here today of freeing traffic, of eliminating congestion. Yet every cent of city funds which goes into the construction of new arteries to its suburbs goes to undermine the tax base of the city itself, unless the city government has taxing jurisdiction in the outlying area benefited by the improvement.

What happens? The city builds a tunnel or a bridge or a boulevard which makes some pleasantly named and pleasantly located suburb easy of access and a convenient place to live in. People from the city move into the suburb and city values decline while the suburban values mount, and the city government, which made the improvement possible, receives not one cent of the increment from the land which it improved.

And if the improvement is made with county funds, or state highways money, the story is still the same. Pittsburgh, with half the population of Allegheny County, pays 65 per cent of the county taxes, and over a period of years it is doubtful whether the city has got 25 cents on the dollar in improvements for the funds it surrenders to the county.

Pittsburgh pays the state government more than $4,000,000 in gasoline taxes each year, and it gets back not one cent in rebates for the maintenance of its own 1,350 miles of streets. When the state does rebate the munificent percentage of one-eighth of the gasoline tax, it goes to the counties and not the cities.

The state can build bridges on state highways, except in Pittsburgh and Philadelphia, its largest cities. The state can maintain state highways only between the curb lines when the state roads pass through cities. The city must light the state highway; it must pay property

damages when it is relocated; it must pay for the relocation of auxiliary structures, such as sewers and water lines.

State constitutions and state legislatures are stacked against the cities. States limit our taxing powers without giving us an equivalent income. States limit our rights of annexation of surrounding territory. They take away our freedom of action without acting themselves. It is no wonder that we have had to turn to the federal government for help. And there are alarming signs that even in Washington the cities are getting the cold shoulder in the legislative halls. In the last session of Congress, every piece of farm legislation passed, no matter what the cost. And we have no objections to that. Prosperous farms mean prosperous cities. Rural electrification is a fine thing. So is soil conservation. But what happened to measures which were designed to help our cities? The W.P.A. was subjected to a 25 per cent sponsor's contribution which will handicap city participation. No new P.W.A. funds were voted. The extension of the credit of the United States Housing Authority was defeated. Self-liquidating works proposals such as might have financed our proposed sewage disposal and water supply systems at preferential interest rates were kicked out. Even railroad equipment loans were defeated.

Some of the delegates to this Congress are men in the federal service. Some of you are in state departments. But the bulwarks of public works in this country are the governments of the cities. To those of you who represent the federal service and the state departments, I bespeak your consideration for the problems of the cities of America. To the city representatives, I can only say that it is high time that we had in this country a city bloc which could function with the vigor, the determination, the unity, and the success of the farm bloc.

The cities are the public works laboratories of the nation. And public works are the very cornerstone of community living. May we all of us continue to be able to render our full portion in this great field of public service.

DISCUSSION

Mr. Roessing: We have one very interesting project under construction at the present time and that is a 600-ton incinerator. The bonds for this incinerator were sold in 1934 and we have been in and out of court ever since. We have attempted to find many locations but as soon as one was selected injunction proceedings were instituted and we would have to move somewhere else. However, after five years

of endeavor we did buy a piece of property to use for a central warehouse depot and as no funds were in sight for such a warehouse we took part of that property and started an incinerator. It has been in the common pleas court, the Supreme Court of Pennsylvania, and, believe it or not, they have taken it to the United States Supreme Court. We don't know whether the United States Supreme Court will accept their appeal or not, but we are taking a chance and going ahead with the incinerator.

The man in charge of the construction, Mr. D. C. Agar, will operate the incinerator upon its completion, and as he is better posted on the details he may be able to give you some interesting facts on this last word in incinerators.

Pittsburgh's New Incinerator

Mr. D. C. Agar: For the interest that the subject of incineration may have for you, I will discuss briefly some features of the plant which Pittsburgh is building to destroy an average quantity of 600 tons of mixed refuse per day.

As Director Roessing has stated, the City of Pittsburgh engaged professional engineers, with whom I had the honor to be associated, to design completely and specify an incinerator plant. This procedure has the effect of placing in the hands of the city the power to obtain maximum quality standards and to prevent the compromises on time and quality that too often result from delegating the design to contractors.

With the active cooperation of the Public Works Department, this plant was designed with a substantial overload capacity and with every effort to make it a fine modern industrial structure that would contribute to an agreeable psychology. I consider the psychological aspect of great importance in the initial stages of such an operation as this, because of the misleading effect imagination often has on the senses.

As to the plant, the tipping floor has been made of ample size for the easy maneuvering of several large trucks simultaneously. The pit is served by two cranes which lift the refuse to charging hoppers at an upper level. The section of the building containing the tipping floor pit and charging floor is enclosed from the rest of the building and has no opening for the outlet of air and regulated openings for the admission of air for combustion. In effect this section of the building constitutes a huge duct for the passage of air to the furnaces and

for the entrainment of dust and odor in this air. Odor of course is destroyed in the furnace, and in the flue and chamber system, dust is settled. It is physically impossible for any dust or odors to pass from this section of the building to the outside or to other sections of the building.

The furnaces are of brick and their grates are perforated over their entire area, making the "burning grate" and "drying hearth" sections only operating names. The mechanism and immediate auxiliaries of the furnaces are conventional. There is, however, a microphone communication between stoking and charging floors which we believe will aid in closer control of material admitted to the furnaces. The flues and chambers are ample and the preheaters are of appropriate size for peaks in moisture and quantity. The stacks have been made 175 feet above grate level to provide reserve draft. We expect this height also to exercise a salutary effect on the confidence of our people in this plant.

The stoking aisle along the line of furnaces has been placed next to an exterior wall amply provided with windows. This feature is distinctive to some extent as the practical outcome of competitive design is not usually such an arrangement, although investment in attractive naturally lighted working quarters is considered sound in general industrial practice.

The dampers are operated from the stoking floor with wheels of large diameter and are built of light weight alloy steel. A pneumatic dust conveyor system is being provided for the more efficient and rapid removal of dust from the passage between the furnaces and the stacks. This should materially decrease the shut-down time for the furnaces.

A scraper conveyor system has been provided instead of the conventional drive-through ash tunnel. With this system the ashes are discharged from the furnace ash pits into a trough full of water where they are thoroughly quenched and, together with dust from the combustion chamber, are carried to an outside overhead bin for quick discharge into trucks.

A freight elevator has been provided for the transportation of dead animals to the furnaces and will, we believe, be generally useful for transporting repair parts to the various levels and for bringing to the ground floor the noncombustibles removed from the charging hoppers.

The treatment of the building interior has been considered with the

idea of making it easy to keep clean. All beam encasements, for example, have been made rectangular to eliminate shelves on which dust might accumulate. Vitrified tile has been widely used.

It is unfortunate that the plant has not yet been completed so that you could see it in operation. The foundation concrete is in place and those of you who have the responsibility of securing sites for similar operations might find a visit to the site of interest.

MR. D. W. GODAT (New Orleans, La.): Are you going to be equipped to take care of dead animals?

MR. AGAR: We have a grease plant that will take care of all of the horses, or most of them, and we are equipped to take care of the small animals which we expect to run between 1,500 and 2,000.

MR. GODAT: Do you put them in direct?

MR. AGAR: Yes, from the side. We can tilt them in a side door into the combustion chamber.

MR. GODAT: Do you have a double opening to prevent the introduction of air, or is it a single opening?

MR. AGAR: It is a single opening but it can be controlled at the fan with a butterfly valve at the air entrance.

MR. W. E. ROSENGARTEN (Ardmore, Pa.): Do you make any use of the heat that is produced, not only from a commercial standpoint, but in heating up supplemental offices in connection with the incinerator or water that may be used for some purpose?

MR. AGAR: We do not make any use of the heat. Power in Pittsburgh at this plant costs a cent a kilowatt and even at the maximum power possibility of the plant, it would cost more to make the power than to buy it. The same is true of, to a limited extent, installing fans and boilers for extracting the waste heat from the waste gases. We went into that rather thoroughly before we were sure it would cost more to do it that way, and for that reason we have put in natural gas fire boilers. They are practically automatic and we are fortunate in this district in having inexpensive natural gas.

MR. W. H. ROBERTS (Rochester, N. Y.): Is your city adopting any ordinance for the collection of refuse separate from noncombustible material?

MR. AGAR: Yes, we expect to haul the mixed combustibles—rubbish and garbage—in one collection, and have a separate collection for ashes and possibly another collection for large noncombustible objects.

MR. ROBERTS: Is your plant so located that you can take care of all parts of the city easily?

Mr. Agar: Yes, but the selection was quite largely a matter of chance. This site is ideal for industrial operation of any sort and particularly so for an incinerator. It happens that it is only a half mile from the center of the city, making the average haul in the neighborhood of four miles one way or eight miles round trip.

Mr. A. Pav (Berwyn, Ill.): What type of equipment do you have, the trailer truck or spot trailer?

Mr. Agar: We do not expect to have trailers, but to have the enclosed and sealed bodies required by state law for this city.

Mr. T. R. Kendall (New York, N. Y.): Do you consider tin cans combustible or noncombustible?

Mr. Agar: Combustible until such time as they are permitted to be collected with the ashes. A certain number of tin cans are helpful to the fire and a certain proportion might well go to the dump as they do in other cities.

Mr. Godat: Is that dump publicly or privately owned?

Mr. Agar: Privately owned.

Mr. Godat: Is it regulated by the city?

Mr. Agar: To some extent. Some of the private haulers go outside of the city, but the city itself uses a regulated and very carefully policed dump within the city.

Mr. J. L. Vincenz (Fresno, Calif.): What kind of a group is it that has instituted the court proceedings? I was wondering if they were some of your former garbage collectors. Are they back of it?

Mr. Agar: It would be hard for me to tell you that. The group is all mixed up.

Mr. N. M. Ulsch (Jacksonville, Fla.): When the garbage is brought to the incinerator will it be dumped into a drying vat and then hauled up to the furnace gradually?

Mr. Agar: It will be dumped into open pits, and of course there will be a certain amount of drying. The pits will have a storage capacity of 600 tons at water level, based on an average weight of 500 or 550 pounds per cubic yard, and the garbage will be hauled up as the furnace can take it.

Mr. Ulsch: Will this be the only incinerator that Pittsburgh will have, or have you some others?

Mr. Agar: This will be the only one.

Mr. Ulsch: When the overhead crane picks up this material will it haul it direct to the furnace?

Mr. Agar: Yes.

MR. G. M. BOWERS (Richmond, Va.): What is your present method of disposal of garbage?

MR. AGAR: At present the garbage is privately collected and hauled to the private contractor's reduction plant at West Newton, about twelve miles from here, but the rubbish is burned here within the city.

Improving Public Relations

E. J. CLEARY

Associate Editor, Engineering News-Record, New York, N. Y.

LAST summer during the course of major construction operations in Cranston, Rhode Island, a telephone call was received by the sewer commission from an old lady. Somewhat timidly she asked, "Couldn't someone at City Hall do something to prevent damage to the trees in front of my home? More than fifty year ago my husband and I planted them on our first wedding anniversary and they mean so much to me."

An inspector of the sewer commission who arrived on the scene ten minutes later found that the old lady was worried about the operations of a crane digging a sewer trench. The long boom would strike the trees, she said, and probably break off some branches. Agreeing with this, the inspector reported the facts to the office, and later in the day when that crane moved forward to a new position, down came the boom, a section was taken out to shorten it, and the operator received instructions to proceed with special care.

In reciting this story I am not implying that citizens in Cranston must plant trees on their wedding anniversaries and wait fifty years in order to gain sympathetic attention from their municipal officials. Rather, this story serves to dramatize the considerate attitude by which one public works administrator distinguished himself in giving concrete expression to the concept of good public relations.

Public relations and all that the term implies does not lend itself to simple definition—in many ways it is an intangible something. Its objectives, however, are not intangible. First, it should strive to eradicate the "public be damned" philosophy frequently adopted by irresponsible civil servants. Second, it should be an endeavor to acquaint citizens with community responsibilities, and encourage

participation—or at least intelligent interest—in common civic problems. Academically speaking, these are the ends to which a public relations program should address itself.

But my discussion will not deal with things academic. This is to be an account of the practical methods used by some communities in promoting better relations. In keeping with a previous statement that such efforts are directed at two basic objectives, namely (1) eradication of the "public be damned" philosophy and (2) development of citizen interest in the public business of their communities, my presentation of examples will follow this classification. First, let me illustrate instances of what I have chosen to call the "public be pleased" concept of municipal service.

The Public Be Pleased

Unfortunate as it may be, it is no overstatement to say that most citizens picture City Hall as peopled with political parasites, or at best by a bunch of incompetents whose inefficiency is exceeded only by their arrogance. And here is one reason why: When Mrs. Jones tries to report that a garbage collection has not been made at her home for five days, she more than likely begins an endurance contest while her call is shifted from department to department until almost everybody in City Hall has been contacted. If she can stick it out, someone finally takes her name and address, and generally that ends the case—but not for Mrs. Jones. Two days later when she calls again to inquire why the collection has not yet been made, no one can be found who ever heard about the complaint. And thus her trial begins all over again.

Contrast this procedure with the system devised by G. E. Wright, superintendent of public works at Corning, N. Y. Here all complaints and trouble reports are directed to the public works department where a clerk records information pertaining to the matter on a printed form. It should be noted that this form leaves nothing to the imagination. And of special importance is the space provided for a time-clock stamp to indicate the hour of receipt, followed by pertinent reminders asking "What did you do about it?" There is little opportunity for "buck passing" here, because everything is recorded in writing and signed. This scheme has a lot to recommend it.

At Rochester, New York, where a director of public relations was appointed last year to serve as liaison officer between the city and its citizens, a touch of finesse is added to the procedure for han-

dling complaints. The office of the director is the central clearing house for all complaints, so that the citizen who calls City Hall is sure to receive immediate attention. And the next morning this person finds in his mail a post card confirming his call and stating the disposition of the complaint. Incidentally, this card contains something more than a cold statement of fact; it carries a sincere expression of willingness to be of service, as well as the name of a responsible officer of the

Form W-32

.... Street .... To ....

Time Rec'd.

CITY OF CORNING, NEW YORK

DEPARTMENT OF PUBLIC WORKS

FILE **Nº 2661**

Accident ☐ Order ☐ Request ☐ Complaint ☐ Trouble Report ☐

RECEIVED FROM:

Name ....

Address ....

Telephone ....

Official ☐ Dept. Head ☐ City Emp. ☐ D. P. W. ☐ Police ☐ Fireman ☐ Citizen ☐ .... ☐

.... ☐ Letter ☐ Telephone ☐ Messenger ☐ Personally ☐

Make complete statement of matter here, attach letter.

If more space is needed use back hereof and additional sheets.

RECEIVED BY .... What did you do about it?

Does this Close matter?

REFERRED TO .... What did you do about it?

Issued WORK ORDER NO'S. 2572............19....

MATTER CLOSED ....19.... **Nº 2661**

Use additional sheet if necessary, attach all reports, letters, etc.

FIG. 1. Complaint form used in Corning, N. Y.

government to whom further inquiries can be addressed. This penny postcard gives almost as much satisfaction to John Q. Citizen as a reduction in taxes, and what is more, it puts him into intimate contact with a personality instead of the inanimate object known as City Hall.

The Cranston, R. I., sewer commission, which I cited earlier as being particularly alert to the opportunities for developing good public

BUREAU OF INFORMATION
Division of Public Relations
DEPARTMENT OF COMMERCE

We have referred your recent complaint about ______________________ to the ______

______________. We trust the trouble

was taken care of promptly and satisfactorily. We appreciate your calling our attention to this matter. Please call on us at any time if you have a complaint or suggestion or desire information about the City government.

Very truly yours,
Jack Burgan, Director

FIG. 2. Postcard used in Rochester, N. Y., to assure citizens that their complaint is receiving attention.

relations, deserves special commendation for the following idea. Cards are sent to every householder on the street where construction work will shortly be undertaken, stating what is to be done and asking forbearance toward any inconvenience that may result. Such thoughtful and friendly consideration of the public interest strikes a new high in governmental courtesy, and it goes a long way toward winning respect and cooperation from the citizenry.

The extension of this idea has all kinds of possibilities for the public works administrator. For example, I understand that at least one state highway department is showing special concern for those who may be inconvenienced by road construction and detours. When the motorist enters the detour area, he is handed a card by an inspector of the department; the message on this card courteously urges the motorist

to drive carefully, expresses regret for the inconvenience caused, and briefly explains the reasons for the new construction and its desirability. This procedure is in striking contrast to the standard practice of posting a sign which bluntly announces "Danger ahead, travel at your own risk." There may be legal necessity for a statement to this effect, but there is no prohibition, legal or otherwise, which eliminates the possibility of doing the same thing in a different way. It might be

SEWER COMMISSION

CRANSTON, R. I.

•

On or about____________________sewer construction will commence on your street. Every effort will be made to avoid any inconvenience to you.

We trust that you will bear with us so that we may complete the work in the least time possible.

Thanking you for your kind cooperation.

SEWER COMMISSION

FIG 3. Cranston Sewer Commission requests and gains public cooperation.

noted in passing that fewer people walk on grass areas where the peremptory "Keep off" signs have been replaced with the compelling appeal that simply says, "Please."

For those who think in terms of money, here is an example of a public relations enterprise that was worth $10,000 to New Haven. Reconstruction of the Ferry Street bridge, connecting areas between which there is considerable pedestrian intercommunication, made it necessary to divert all traffic to a river crossing about a half mile removed from the closed bridge. To minimize the inconvenience to those who had to cross the river every day (largely mill workers and school children) the city has placed in operation a free bus service with terminals on each end of the former bridge. It will take one and a half years to complete the bridge, and bus service contracts will total about $10,000 in that time. Favorable reaction to this special concern

for the public welfare has convinced New Haven officials that this money is being wisely spent.

Now just a word about the thoughtfulness of the Brookline, Massachusetts, authorities. Doctors who are treating people who need rest and quiet are requested to inform City Hall of the patient's address. Within a short time, "Quiet Zone" temporary signs are placed at each end of the block on which the patient lives, and there they remain until further notice.

For Better Understanding

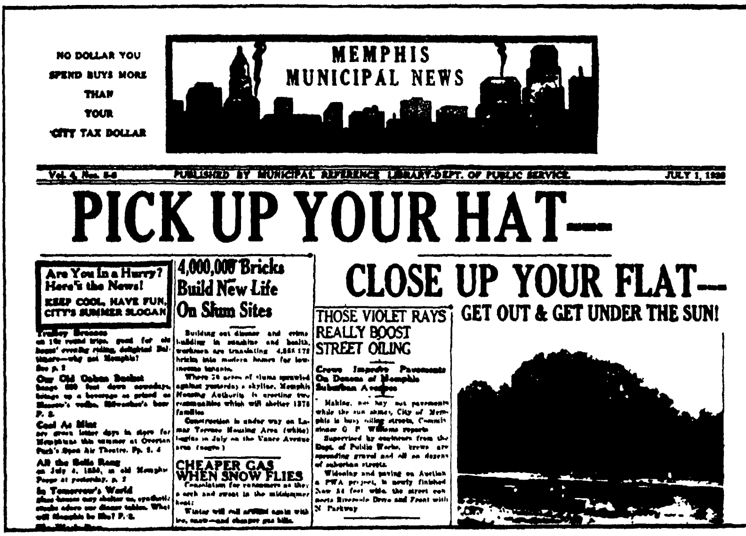
Thus far I have concerned myself with public relations ideas designed largely to create good will and minimize inconvenience. The following relates to public relations activities whose objective is to enlist citizen support and interest. These might be classified as falling in the category of selling public works to the public.

Ranking high in importance as means for acquainting the public with what is being done and why is the intelligent use of such facilities as the local press, attractive annual reports, motion pictures, and the radio. During the last two years much has been written concerning the effective application of these four media in awakening public interest in community affairs. Therefore, rather than risk repetition, I refer you to the appended list of some recent articles dealing with these more familiar phases of public relations.

However, I would like to recommend for your consideration several lesser-known methods of stimulating citizen interest. As exhibit A in this group, I show you the tabloid newspaper published bi-monthly by the city of Memphis. This four-page newspaper is the offspring of a small mimeographed bulletin first published three years ago. Its popularity and usefulness as a means of informing citizens about municipal affairs led to the present tabloid form. Five hundred copies are printed at a cost of about $35. It is made available to callers at City Hall and, in addition, copies of every issue are mailed to civic clubs, P.T.A. groups, schools, and to prominent business and professional men. Based on information given to me by Jack Burgan, director of public relations at Rochester, I would make one addition to this mailing list—namely, all the barber shops in the city. Mr. Burgan found that copies of the annual city reports which were sent to barber shops have been pretty well thumbed over, thus indicating that the attention of the man waiting for a haircut or a shave is easy to capture.

Another scheme for selling the citizens on what the city offers is

the yearly municipal "open house" or exposition. Berkeley, California, Toledo, Ohio, and Rochester, New York, conduct such affairs. That the public is greatly interested is indicated by attendance numbering 12,000 at Berkeley and 9,000 in Toledo last year. A building with lots of floor space, such as an armory, is ideal for the open house show. Early department of the municipal government has an oppor-


NO DOLLAR YOU SPEND BUYS MORE THAN YOUR CITY TAX DOLLAR

MEMPHIS MUNICIPAL NEWS

PICK UP YOUR HAT—

Are You in a Hurry? Here's the News! KEEP COOL, HAVE FUN, CITY'S SUMMER SLOGAN

4,000,000 Bricks Build New Life On Slum Sites

CLOSE UP YOUR FLAT—

THOSE VIOLET RAYS REALLY BOOST STREET OILING

GET OUT & GET UNDER THE SUN!

CHEAPER GAS WHEN SNOW FLIES

FIG. 4. Memphis tells citizens about municipal activities.

tunity to tell what it does and how it is done. The public works department, for instance, can display equipment used in carrying out its work, and models can be shown of municipal utilities and projected improvements.

Perhaps the most spectacular municipal public relations stunt in the country is that staged by the city light department of Seattle. For the small sum of $4.05, a Seattle citizen or visitor can take a two-day tour of the municipally owned hydro-electric works located in one of the most magnificent mountain regions of the Northwest. By train, boat, and inclined railway, the tourists are taken from place to place on this project and overnight they are housed and fed in a remodeled contractor's camp near one of the dam sites. A special feature of the trip is a visit to the construction operations at Ross Dam, where the first stage of a 650-foot structure is being built in the Skagit Canyon. Both week-end and mid-week excursions are scheduled, and

they are so popular that this year accommodations have been provided to handle 1,500 people a week.

It is appreciated, of course, that not every municipality has a Skagit project to show to its citizens. But many communities do have something which might have popular public appeal. For instance, Roy Phillips, city engineer at Meadville, Pennsylvania, has fitted up the grounds of his water plant with picnic areas. The groups attracted here for one-day outings are thus brought into close contact with their most important community service—water supply. And contacts of this sort have a value that can never be measured in dollars and cents.

This leads me to say, in conclusion, that the yardstick of dollars and cents can hardly ever be applied in measuring the benefits given or values received from the pursuit of a program of public relations. Such a program cannot be considered a luxury or an appendage of public service enterprise—rather, it must be recognized as one of the essential elements of humanized and efficient administration.

Some Recent Articles on Public Relations

"A Newspaper Man Looks at City Hall," Hal Hazelrigg, *Public Management,* March 1938, p. 67.

"As Others See Us," Clifford Mozier, *Engineering News-Record,* March 30, 1939, p. 439.

"Jacksonville Broadcasts Talks By Street Cleaning Personnel," Anon, *The American City,* July 1938, p. 65.

"Keeping the Public Posted," Roy Phillips, *Engineering News-Record,* June 22, 1939, p. 851.

"Meaning and Scope of Public Relations," E. D. Woolpert, *Public Management,* September 1939, p. 259.

"Municipal Activities in Movies," John Devine, *Public Management,* March 1939, p. 67.

"Public Opinion by Postcard," S. M. Weaver, *Public Management,* May 1939, p. 138.

"Selling Public Works to the Public," E. J. Cleary, *Engineering News-Record,* December 22, 1938, p. 794.

DISCUSSION

MILES E. EVANS
Director of Public Service, Cleveland, Ohio

I AM INCLINED to believe we pay too little attention to this matter of public relations. Those of us who are in public service are inclined to look upon the general public as composed of a group of unreasonable individuals whose chief purpose in life, and certainly whose major activity, is thinking up embarrassing questions and aggravating criticisms. On the other hand, there is a popular misconception that the sole interest of the public official is in drawing his salary and perpetuating himself in office. Of course we are both wrong—but I am inclined to think that perhaps we in public service are more at fault. I think that perhaps we have shown indifference to the public and that in many cases we have shown a lack of intelligent effort to solve the problem of our relationship with them. I believe that the improvement of our public relations is just as much a public improvement as the design or construction of a sewer or pavement, entitled to the same careful planning and consideration and the same vigorous and diligent prosecution.

A complaint to us often seems trivial and unimportant, and yet to the person making the complaint it is just about the most important thing on his mind at the moment. Of course, the wrong way to handle it is to give him the run-around. I am afraid that is what often happens. The complainant is looking for a courteous and sympathetic hearing, and preferably a hearing at the hands of some one who is in authority or at least some one whom the complainant thinks is in authority. I have often wondered if it wouldn't be a good idea to give our complaint clerks, if that is the medium that we use, some high-sounding title. At least the person making the complaint would feel that he was talking to someone who did have some authority.

I wish I might say that in Cleveland we have discovered some panacea for all these ills. Unfortunately, such is not the case. I was much interested in the excellent system in effect in Corning, and I am impressed with the idea of a director of public relations. We have made an approach to that in Cleveland in that the mayor has an executive assistant in charge of public relations, part of whose duty is handling the many complaints that come to the mayor's office. These are referred by him to the various departments and divisions,

and the complaints are acknowledged—not as promptly, however, as they should be. In my own department, the department of public service, the director has an executive assistant, one of whose duties it is to handle major or aggravated complaints. We find that investigation of the complaints and personal contact with the complainants, where the case warrants it, are the most satisfactory, both to the department and to the complainant. It is the personal contact, our experience proves, that is the most beneficial.

Of course the handling of complaints is just one phase of our public relations, as Mr. Cleary has pointed out. We have used radio and moving pictures and as much publicity through newspapers as we are able to obtain. I want to tell you about a radio program we have arranged which has been one of the best things, so far as our public relations are concerned, that has been evolved in the city for some time.

Mayor Burton, three or four years ago arranged with a local radio station for a bi-weekly radio program. The radio station was glad to donate the time and every other Saturday night we have a program known as "Our Town," fashioned after the old New England town meeting. The mayor acts as moderator of the meeting, and introduces the director and commissioners of a department who discuss for twenty minutes the work being done by that department. We try to bring out any unusual features of the work with which the general public is usually unacquainted. As a result of this program, we have found that the public is highly ignorant of what is going on in the city. After the discussion there is a ten-minute question period. The general public is invited to attend the meetings and they come to the studio in substantial numbers. Questions are submitted by them and also by telephone. The questions are repeated into the microphone and then they are answered by the person most familiar with the subject matter. There has been a great interest built up, and I think it is one of the most beneficial things that we have done toward improving our public relations.

In conclusion, I simply want to say that any effort by public officials which brings the general public closer to the City Hall is worth while and is bound to pay substantial dividends.

Controlling Subdivision Development

Myron D. Downs
Engineer and Secretary, City Planning Commission, Cincinnati, O.

Too much thought has been given to the quantity of physical expansion of cities and far too little thought is being given to the quality of those physical extensions of public services which we speak of collectively as subdivision growth. The actual growth or expansion of most cities results from the subdivision of acreage into building lots. If this process of subdivision is good in its details, the developer will profit materially by the early sale of all lots, the buyers will profit as the result of satisfactory living conditions and good resale values, and the community will profit by the permanence of substantial values created. If, however, the details of subdivision are poorly conceived in the planning stage, or if they are executed without attention to good engineering practice or without adequate, competent supervision, then the developer may experience financial difficulty or even bankruptcy, the buyers will suffer constant irritation, and the community will be the loser as population shifts from unwanted areas to newer and more desirable areas. The less desirable areas are then given the unsavory label of "blighted area" or "slum." Some persons prefer the explanation that the slum dweller makes the slum and that a slum condition does not produce the slum dweller. In either case, the character of the neighborhood bears a very direct relationship to its initial subdivision or development for urban use.

Cincinnati has materially improved the quality of its physical growth during the last fourteen years through the cooperation of its city council, city planning commission, and the city engineering offices under the city manager. This process, entered into jointly by the planning, legislative, and administrative branches of the municipal government, is most important in the production of a better commodity—sites for buildings.

The planning commission in 1925 adopted "Rules and Regulations Governing the Platting of Subdivisions within the Jurisdiction of the City Planning Commission," which jurisdiction extends throughout the 72 square miles of the city's area and within 3 miles thereof. This authority had been anticipated by the framers of the city charter as a function of government of importance equal to or greater than the park, health, recreation, and sinking fund boards. The authority to

regulate subdivision development in the 3-mile area outside the city limits is delegated by both charter and statute.

The General Code of Ohio provides:

4366-3 Planning commission shall be platting commission. The municipal planning commisson shall be the platting commission of the municipality, and all the powers and duties provided by law for platting commissioner or commissioners of municipalities shall upon the appointment of a municipal planning commission under this act, be deemed transferred to such commission.

The Charter for the City of Cincinnati provides:

Section 7. The City Planning Commission shall be the Platting Commission of the City, and, as such, shall have the control of platting and shall provide regulations governing the platting of all lands within the City or within three miles thereof, so as to secure a harmonious development and to provide for the coordination of streets with other streets and with the official city plan and to provide for open spaces for traffic, utilities, access of fire-fighting apparatus, recreation, light and air, and for the avoidance of congestion of population. Such regulations may include requirements as to the extent to which and the manner in which streets and other public ways shall be graded and improved, and to which water and sewer and other utility mains, piping or other facilities shall be installed, as a condition precedent to the approval of the plat. In lieu of the completion of such work previous to the approval of the plat, the Commission may accept a contract secured by a bond in an amount and with surety satisfactory to the City Manager, providing and securing to the municipality the actual construction and installation of such improvements and utilities within a period specified by the City Manager and expressed in the contract and bond. The City Solicitor is hereby granted the power to enforce such bonds by all appropriate legal and equitable remedies. All such regulations shall be published as provided by law for the publication of ordinances, and before adoption a public hearing shall be held thereon, and before the same becomes effective a copy thereof shall be filed with the Clerk of Council. In addition to the powers expressly specified in this Charter, the Commission shall have all powers of control over plats and subdivisions granted to City Planning Commissions by the statutes of Ohio.

Section 8. All plats of the subdivision of lands within the corporate limits of the City or within three miles thereof, and all instruments of dedication of lands for public use, shall be submitted to the Commission and approved thereon, in writing, by it before they may be offered for record or accepted by the City. The approval of the Commission shall not be deemed the City's acceptance of the dedication of any street, alley, way or other public ground shown on the plat or set forth in the instrument.

No street, alley, way or other public ground shall be accepted by the City as a public street, way, or ground, unless the plat and location thereof shall have been submitted to and approved by the Commission; provided,

however, that Council may submit to the Commission any ordinance proposing to accept the dedication of any such unapproved street, alley, way, or ground, and if approved by the Commission, Council shall have the power to accept the dedication thereof by a majority vote, or, if disapproved, by a vote of not less than two-thirds of its members.

However, the planning supervision of the commission over plats is ordinarily impotent and does not *alone* produce the desired control of physical growth. Accordingly, it was thought desirable to invoke the legislative authority of the council to regulate and restrict the issuance of permits by administrative departments to only those streets that are part of subdivision plats approved by the planning authority. Under the provisions of the ordinance:

Section 72-3. The departments, officers, and employees of the city or any of them shall not accept, lay-out, open, improve, grade, pave, curb, or light any street or other way, or lay or authorize water mains, sewers, or water, sewer or other connections to be laid on, in or under any street or other way, unless such street or way

(a) shall have been accepted or opened as or shall have otherwise received the legal status of a public street or way prior to the effective date of this ordinance; or (b) unless such street or way corresponds in location and extent with a street or way shown on a recorded plat approved by the city planning commission; or, (c) unless the location and extent of such street or way shall have been first submitted to the planning commission for its approval, and shall have received the approval of the planning commission, or, if disapproved by the planning commission, shall have received the favorable vote of not less than two-thirds of the entire membership of Council.

all new streets opened and improved must be in accordance with approved preliminary plats. At first, approval of plats was withheld until sewer and water main sizes and locations had been agreed to between the municipal engineering departments and the subdivider's engineer. The commission amended its rules in 1929 to facilitate the commencement of construction of subdivision street work by adopting the following rule:

The tenative approval of the preliminary plat by the planning commission is to be considered as merely a general approval of the layout submitted, and it is thoroughly understood that the city manager shall examine and report as to the grades of the streets, the type of improvements, the layout of the drainage and sewer system, the water distributing system, and shall have the power to modify any such engineering or construction details submitted by the subdivider wherever advisable for the protection of the city's interest.

In order to expedite reports by the staff of the commission, it has been found desirable to prepare advance plans of quarter-section areas within and adjacent to the city limits. Such plans are not *given* to an owner or broker, but are referred to at once upon submission of a preliminary plan of subdivision by a registered surveyor, accompanied by a letter signed by the owner of the property requesting approval of the plan submitted. This procedure has been welcomed by the surveyors, since it speeds their work materially and tends to produce a more satisfactory situation for owners of adjacent acreage who may in time become clients.

Under administrative orders of the city manager, the highway, sewer, and water departments have developed uniform departmental regulations resulting in equitable treatment of all developers. Inspectors in the employ of the city observe and report upon all installations, their time being billed semi-monthly against a deposit put up by the developer at the beginning of work. In this way, the engineering departments are enabled to clear immediately any completed subdivision when the final plat is presented for the final approval of the city planning commission, a condition precedent to legal acceptance by the county recorder. Correspondingly, if a final plat is presented to the commission without "certification by the proper officials (that is, by the city engineer and city manager) that the necessary provisions as to the grading and improvement of the proposed streets have been carried out" the plat is immediately returned to the developer for conference with regard to incomplete work.

Actually, little if anything is done in cities of the United States to *control* subdivision development if we define "control" as meaning literally "to restrain" or "to check." Only through much more rigid restraint of the extension of water and sewer lines than we ordinarily find in a community governed by a number of citizens elected by popular election will complete subdivision control be realized. How far additional restraint should be applied legislatively is a major question for discussion. At what point would the conflict between carefully planned *control* and unreasonable *restraint* upon private property rights reach an impasse? Apparently the question involves details of mutual understanding between public officials and private developers which are better handled without too much legislative restraint. Active planning, constant gathering of information with regard to supply and demand, and private rather than public financing of utilities seem to offer a guide to better subdivision development.

DISCUSSION

Mr. Downs: Along the line of the last thought, in the low years of 1932, '33 and '34 you read much about the good condition of Cincinnati financially. In all fairness it must be stated that between 1929 and 1933 approximately $100,000,000 was expended for various terminal facilities by the main line railroads entering the city, both individually and collectively as a terminal corporation. It had never been done before, and it won't happen again for a long time, if ever. Secondly, Cincinnatians are by nature rather conservative. We have no great booms. We have no deep depressions. But, thirdly, we did adopt in 1927 the present legislative, administrative, and planning control of land development, which cut out speculation very largely. The developer of a subdivision finances *all* construction. He cannot just buy the land and then get the county commissioners or the city council to put in utilities under municipal bonds or county bonds. He must first convince his banker that he is about to produce a saleable commodity, just as if he were going to make hats or socks or automobiles.

Therein lies the story of why, when cities of our class had from 100,000 to 500,000 usable vacant lots, we had 19,000 at the bottom of the depression.

A Member: Where do you run the sewage in outlying districts?

Mr. Downs: We run too much of it into individual septic tanks. In Ohio the tax savers have made it mandatory for a municipality or a county to get a 65 per cent majority in order to get a referendum bond issue outside of the one-mill limitation. It is very difficult to get a 65 per cent majority for public improvement bonds that do not have an emotional appeal. You can get money to repair a hospital, or money to build a school. But when it comes to getting money to put in a sewer it's a different matter.

The septic tank is approved under the regulations of the state board of health as administered by the county health commissioners. An unfair situation exists because the purchaser of a house pays $250 to $400 for that septic tank and then, as, if, and when the sewer comes along and he is in the sanitary district he is ordered to put in a sewer. There is another $250 to $400, making a double charge for a sanitary requirement. We haven't yet reached the millennium and here is one of the weakest spots.

Mr. W. A. Heimbuecher (University City, Mo.): Do you make the developer pay for the full price of a 24-inch sewer?

Mr. Downs: Yes, sir. The theory is that one man buys a piece of land and expects to make a profit. Out of the gross that he receives comes all the cost of improving that piece of land. One man buys high priced, first cost land and pays only a little for his improvements. Another man buys cheap land, poor land which requires a large expenditure for installations, and he may or may not come out better than the first fellow.

That theory has become practice entirely. It is mandatory under the ordinances of the city, the rules of the commission, and the regulations of the city engineer's office.

Mr. Heimbuecher: Is that a sanitary sewer or combined sewer?

Mr. Downs: All sewers in this section are combined.

Mr. W. E. Rosengarten (Ardmore, Pa.) Who maintains the walks?

Mr. Downs: The right-of-way of a street or walk, when dedicated, is maintained entirely at the city's expense. That is the equity of requiring the developer to follow city specifications: the city engineer knows what he is getting, and the council knows that it is not going to pour good money in after bad.

Mr. G. M. Bowers (Richmond, Va): Is that true of park areas?

Mr. Downs: No, sir. They are entirely owned and developed by the city.

Mr. Bowers: Where the subdivider is required to set aside and allocate certain areas of land for park purposes, does the city maintain the park areas?

Mr. Downs: The independent city park board does. They not only maintain but they make the initial development.

Mr. Bowers: And the city maintains it after that?

Mr. Downs: Yes.

A Member: Do you light the cross walks back inside?

Mr. Downs: No. They must be straight so that they can be lighted from a lamp placed at the intersection of a street and at the end of the cross walk.

In our community last year there were about 1,138 new houses built outside the city limits as against about 1,160 built inside. There are other incorporated places in the county but in the search for cheap lots too many on county roads, without drainage, without adequate sewers, without adequate water pressure, and without sidewalks are being sold to the public. I think it is a challenge to all of us to put a stop to that someway, if we mean by subdivision control having any check or restraint on subdivision development.

MR. SAMUEL H. STRICKLAND (High Point, N. C.): In our small town we have done quite a lot of planning, but the thing that interested me most in Mr. Downs' paper was the control of the subdivision development. I see the need for such control in our city. We have had a great deal of the kind of development Mr. Downs is fighting.

We do have a very active planning commission, and a comprehensive city plan, showing the main thoroughfares to be built. While we are following that very closely, we are very slack in the control of sewers, water mains, and street paving. Frankly, we don't know what to do about it. However we are considering an ordinance along the line of Mr. Downs', which requires that the developer shall put in these improvements prior to acceptance or else furnish bond that it will be done. I don't know how it is going to work out. I imagine Mr. Downs has had a hard job getting the developers to do that work. Perhaps we will quit developing property when we do enforce such an ordinance.

LYONS MUSSINA

City Engineer, Williamsport, Pa.

FOR A number of years I have been familiar with subdivision platting and development in many urban communities and what I have to say should be considered generally and not as an experience of any one city or community.

It is refreshing to those of us who have to do with the engineering problems of municipalities to hear of the success of Cincinnati in controlling subdivision development. Mr. Downs' paper gave us a detailed and complete summary of the various steps and procedures made necessary by that city in providing for quality in its physical expansion. It also gave us an outline of the teeth in the procedure, whereby the city is assured of positive results.

The code as outlined is worthy of imitation. Many cities, however, are not blessed with the fine cooperation of planning, legislative, and administrative bodies of which Mr. Downs speaks. While many of them have the planning and legislative authority, in far too many cases the administrative authority is indifferent to the enforcement of planning measures. This tendency has been apparent, and increasingly so, during the past decade. May I cite some illustrations of the lapse of interest in some of our cities or urban districts? Perhaps they are all too well known to many of us.

Here in Pennsylvania we have an organization known as the Pennsylvania Association of Planning Commissioners. They hold annual meetings. For years they have been trying to formulate some means of inducing their sponsors generally to control subdivision development to a greater degree. Too many commissions themselves are inclined to do things the easiest way. Many of them serve without salary and in some cases without even operating expenses. Some operate without a definite code or without adopted rules and regulations governing the platting of subdivisions. Each case brought before them is decided upon its own merit, in some cases without reference to a general city plan. Many of the developers in some cities never give the matter of public services any definite consideration, nor are they required to do so on plans submitted to the planning commission for approval.

Most small cities today are hungry for physical expansion and development. They seem to be content to have growth without too many strings attached, so to speak. Tax collections are poor, generally speaking, and almost any projected development or expansion which will produce taxes will tend to influence the approval of plans, no matter how poorly conceived these plans may be. This seems particularly true in regard to control by zoning and in the details of subdivision development. Recreational areas, gas and water services, and in some cases the development of sewers are not considered. If these are not publicly owned and operated, the situation is further complicated. These features inevitably act to retard proper development.

Happily, there are many cities which cannot be accused under this general indictment, but most of them can profit by adopting more rigid and thorough standards from developers.

The whole situation resolves itself into a matter of community interest, and to create that interest demands the cooperation of all public agencies concerned. It is in this regard that the engineer may be a tremendous help and a coordinator for the development of his city according to his dream.

Mr. Downs is entirely correct when he says that too much thought is given to the quantity of physical expansion of cities and too little thought is given to the quality of subdivision growth.

GAMBLE M. BOWERS

Director of Public Works, Richmond, Va.

IN VIRGINIA, and more particularly in Richmond, we have the Plat Act, passed by the assembly of the state, giving the City of Richmond control over subdivisions both within the city and within five miles of the corporate limits. That merely gives us control as to platting.

We have adopted rules governing that control, and as a preliminary to it we have made a complete topographical survey—plane table survey—of the entire area, consisting of about 126 square miles. The topographic maps are 200 and 400 feet in scale, with contour intervals 2 and 4 feet.

With this complete picture of the terrain, when a prospective subdivider comes in with his land we have some advance knowledge of the proper location of the streets, their connection with existing roads and arteries, and more particularly with drainage.

We do not, however, have any control over the improvements. In Virginia we do not assess, either in the city or outside, public improvements against the abutting property. Such improvements come out of the general fund. Therefore, when a subdivider comes in we approve his plat, he places it upon record (and he cannot place it upon record without our approval), and then he proceeds to make his improvements. If he wants to follow our standards for sewers, water mains, and so forth, and we approve his detailed plans, supervise the construction, then we will compensate him for the fair value of those improvements six months after annexation of the territory. That is a binding agreement between the subdivider and the city.

However, if he desires—and some do—to make those improvements without submitting the plans to us for our approval, there is nothing to stop him. Then the city does not obligate itself to purchase the improvements. However, if the city uses the improvements after annexation we then must compensate him for their fair value. That is the law. Under that plan we may use them all, use part of them, or use them not at all.

That is control without restriction and that is the situation under the law in Virginia. We do have complete topographic surveys. We do have complete and basic information for the layout and platting of the subdivision. But we are woefully and dreadfully lacking in control.

Chairman Storrer: I should like to ask Mr. Downs how long they have been controlling subdivisions. Since he says they had 20,000 vacant lots they must have been controlling it for a long time.

Mr. Downs: The ordinance that put the teeth in things was passed November 27, 1927.

Mr. Stewart M. Weaver (Montclair, N. J.): Suppose the master plan calls for an 8-foot sewer on one of these streets which is a part of the trunk line system in that area. Is that subdivider required to put in that 8-foot sewer entirely at his expense?

Mr. Downs: Yes. I will go you one better. We have an area known as the Egan Tract which has been in a certain family for years. In that area they were developing a 24-inch line. They are now constructing a box 15 x 9 feet in that same acreage to carry a creek called Ross Run, all at their own expense. That was cheap land to start with, and it was cheap partly because it was subject to the overflow of this creek. If a man had the same number of acres on high dry land that drained off on another fellow's property, he would pay more for it in the first instance and less for his improvements. It is a perfectly fair theory.

There are many contractors in Cincinnati who have purchased holes in the ground and property that has bad draws through it, having in mind specifically that when their crews are not working for profit for someone else they will be putting in the box or the big sewer, and gradually put excess fill on the land. This not only enables them to keep their crews together, but at the same time they are developing poor land at high expense and coming out on the right side. I know of three contractors who have been doing that actively over a period of years on some very bad land. They count on footing all the bills themselves.

Chairman Storrer: Mr. Downs, you spoke of cheap lots. What is your idea of a cheap lot and what is the price range of the lots on which the completed package sold for $5,000 to $6,000?

Mr. Downs: I don't know whether there are any F.H.A. men in the room or not. I should like to be corrected if I make a misstatement. I believe their idea of a low priced lot is $600 to $800. We believe that the honest price of the low priced lot is $1,100 or $1,200 with everything in.

Chairman Storrer: For how many front feet?

Mr. Downs: The average is 45 to 50 feet.

Chairman Storrer: I don't know whether that price is the result of your planning since 1927 or not, but in most places lots that are

fully improved by special assessment and have gone through the wringer during the depression can be picked up for $500, or perhaps some of them even for $400 up to $1,000. That is the situation in which a great many cities find themselves. You fortunately don't. Is that the result of your long-time subdivision control?

MR. DOWNS: I wouldn't say one can't buy $300 or $400 lots in our county, but there is always a reason for it. It usually has something to do with the physical improvement in the front of the lot. It may be four miles to the nearest bus line or off any existing school bus route. It is usually something of that kind that runs the cost down.

We don't have any such lots in Cincinnati, not in 72 square miles. Our sheriff sold no lots at all during the depression.

MR. W. E. ROSENGARTEN (Ardmore, Pa.): I should like to ask when and how these private roads are made public.

MR. DOWNS: By the acceptance by the city council, through ordinance, of deeds describing the land shown as a street within the plat.

MR. ROSENGARTEN: Does that come by way of petition from the owners or does the city take the action?

MR. DOWNS: The developer wants to get his maintenance cost off his shoulders as soon as possible. Therefore, as soon as he has put in his improvements he files a final plat which, when it comes up to the planning commission, has the approval of the city manager and the city engineer, saying that everything has been put in in accordance with city specifications and in accordance with the preliminary plat. The commission, under those circumstances only, gives its approval. The developer then records it and immediately offers a deed to the city. The solicitor draws an ordinance to accept the deed, and from that time on the city pays all maintenance, cleans the manholes, sweeps the streets, puts filler in the joints of the concrete pavement, takes over everything.

MR. ROSENGARTEN: Do you require any extent of development before it is accepted?

MR. DOWNS: Complete development.

MR. ROSENGARTEN: I mean building of houses.

MR. DOWNS: No, sir. We don't have any streets that don't develop. That is where selling the idea to the bankers comes in. We don't have the situation that was found in Wayne County. If you gentlemen haven't seen the Wayne County, Michigan, report on their subdivisions it behooves you to see it, from both the engineering and financial angle. In Wayne County the equivalent of 15 square miles of im-

proved subdivision property, with sewers in at the county's expense, water mains in, with paving down, and with white-way lighting on much of it, went back to the domain of the State of Michigan because there were no takers at sheriff's sales. Fifteen square miles of that stuff!

That is all because Joe Brown went out and bought so many acres under the sky. Then he went to the Wayne County Road Commissioners. They were good fellows and they put everything in for him. The County of Wayne held the bag to a tune that is astonishing.

That report was made and printed at the request of the comptroller of the county. It wasn't any planner's idea or engineer's idea—the finance man had it published. If you haven't a copy already, you can get one. It is broadcast all over the country as a warning.

CHAIRMAN STORRER: You made it a little more clear than I did. I said the lots could be bought for about $400. As a matter of fact, that represents the taxes.

Tentative Subdivision Standards

FREDRICK R. STORRER

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(Chairman of the Committee on City and Regional Planning*)

THE TYPE and pattern of most subdivisions is determined by the street plan. The street plan divides property into areas for private uses and provides for their servicing. Major traffic streets, if established prior to subdivision of land, constitute the primary factor in determining the pattern and fashion of subsequent subdivisions. The secondary street plan may take its form from, or reflect the influence of, major street plans. Because little can be done to change its basic pattern after a street plan is adopted, this phase of subdivision layout should receive particular attention and study. The familiar rectangular pattern so common in most cities is monotonous and does not lift the subdivision out of the commonplace. It offers very little

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opportunity for variety within the subdivision relative to the size and shape of lots, and it does not fit irregular topography. Because the rectangular plan provides streets all alike, no economy in design of roadway surfaces or other utilities can be effected. In such a plan traffic uses streets indiscriminately, necessitating a greater factor of safety than when the opportunity for such indiscriminate use is denied.

Limited Access Highways

Streets divide roughly into four classifications. First are the highways providing for through traffic, i.e., providing the shortest possible route between a point outside of the city to a point outside of the city on the other side, and are referred to as "major through traffic highways" or "limited access highways." On these highways it is important that the needs of traffic be paramount and not in any way be subservient to property adjacent. For this reason, access should be limited and loading and unloading facilities should be off the traffic way. Cross streets should not enter such highways except at intervals where proper division can be made to separate cross traffic. Such intervals should not be less than one-quarter mile and preferably greater. Driveways and alleys should not enter the main traffic way. Access for such outlets may be provided by means of service roads paralleling the direction of traffic and by accelerating or decelerating lanes. Curvature should be limited to 3° and maximum grades to 4 per cent. Such highways should be routed to be easily accessible to central business areas but should not enter such area. It is inadvisable to by-pass the central business area by any great distance since experience has shown that this will prohibit its serving the district. Likewise, it should go around rather than through the residential districts. The width of these highways is recommended as 160 feet minimum, apportioned as follows: central dividing strip, 15 feet; two roadways 32 feet each side; two 10-foot planting strips each side flanked by two access roads 18 feet each; two sidewalks 12.5 feet each; total, 160 feet. Planting strips and access road space which will be the last to be constructed offer space for installation of utilities. The above represents the minimum requirements only. At intersections, planting and dividing strips should be increased in width to provide accelerating and decelerating lanes or turning space for vehicles. Right-of-ways should be further widened to include ramps and side slopes where the elimination of crossings at grade makes this necessary.

Major Traffic Streets

The second type of highway is distinguished from the first by the purpose it serves. Such a street serves the property abutting, together with all adjacent and surrounding territory. It is, therefore, impossible to limit access and it must provide for curb loading and unloading. Such streets will originate and terminate within the city or metropolitan area. Maximum curvature and grades should be the same as for the limited access highway. The requirements of these highways in business districts are somewhat different than in residential or semi-rural districts.

Spacing of major traffic streets at intervals of one mile is generally found to be adequate; it works out well in closely built-up areas and fits in with section-line roads in the rectangular plan. Developed as radial streets they will serve well, since in outlying areas their wider spacing is proportioned to the smaller density. Such streets should be continuous and provision should be made for their extension in subsequent platting. Right-of-way for major traffic streets for closely built-up business districts is a minimum of 120 feet. It is suggested that the width be apportioned as follows: four lanes of traffic in each direction but not separated in center, requiring 80 feet between curbs, 10-foot planting strips and 10-foot walkways on each side allowing for installation of utilities. Walkways should be extended into the 10-foot planting strips as business needs require. In residential districts it is recommended that access roadways be provided in order to eliminate driveways and many means of access to the highway between blocks. In this instance the 8 feet used for curb loading is eliminated. Planting strips should be increased to 15 feet to provide a partial barrier to traffic on the central paved portion. This requires a right-of-way of 150 feet with a suggested apportioning as follows: central paved traffic way, 64 feet; two planting strips, 15 feet each; two service roads, 18 feet each; two sidewalks and parkways, 10 feet each. Additional widths are desirable and should be obtained when the advantages are not offset by the disadvantages in acquisition. All streets entering such highways should be at right angles or nearly so to avoid dangerous angles of approach and poorly shaped lots. Where other local streets are platted intersecting the major traffic highways, their longest dimension should be parallel to the line of the right-of-way of the major traffic street, thereby avoiding excessive interference at intersections.

MINOR TRAFFIC STREETS

The third type of thoroughfare, providing a traveled way of 40 feet on an 80-foot right-of-way, should be laid out to serve as feeders to the major streets. They should intersect the other streets at right angles, and grades and alignment should be such as to accommodate through traffic between major traffic streets and should flow naturally to them. Continuity is not essential except between major traffic streets and if they are located at intervals of approximately one-half mile they offer an excellent opportunity for platting super-blocks in which there is no invitation to through traffic to enter, thereby decreasing accident hazards and any nuisance associated with traffic.

LOCAL SERVICE STREETS

The fourth type of street serves purely local needs. Such streets should discourage through traffic and should not be continuous. Streets platted through from street to street should be platted with their longest dimension parallel to the direction of the major highway, and, if they are over 800 feet long, they should be bisected with a walkway. Platting of short cul-de-sacs not exceeding 400 feet in length on 40-foot or 50-foot right-of-ways, having minimum diameters of 90 feet at their ends for turning, offers considerable economy in utility installation and pavements. Rarely will it be necessary to construct sidewalks on these short streets. The use of crescent and U-shaped streets starting and ending on the same highway is also a means of discouraging indiscriminate use by traffic. Such right-of-ways need not exceed 60 feet and it is often found that 50 feet will suffice, with the consequent saving in land area. Local service streets, as far as possible, should be entered only from minor traffic streets. This eliminates interference with the major traffic flow. Platting of half streets at the boundaries of the subdivision should be avoided, unless the land outside the subdivision is in the same ownership and its development can be controlled, since a subdivision of entirely different character may develop on the opposite side of the street. Any necessity for platting half streets at subdivision boundaries is generally occasioned by major traffic streets, in which case the greater width of street serves as a barrier to different character of use.

ALLEYS

The use of alleys except to serve business districts is not recom-

mended. In residential districts their cost of maintenance is far greater than the cost of servicing the properties from the street. Lots should be platted of sufficient width that access by alleys is unnecessary. It is recommended, however, that easements be provided for the installation of utilities requiring poles or lines since these utilities are much less objectionable if they are located off the streets.

Land Use Requirements

Subdivisions should proportion land for residential use, commercial, industrial, and public use in accordance with some well balanced scale. The amount of any one use is largely dependent upon size, surroundings, and location of the subdivision. Large subdivisions may contain all four uses, and their relative amounts and proper relationship should be determined. It does not necessarily follow that merely because a subdivision adjoins industrial property or railroads that the land closest thereto should be platted for industrial or commercial uses. Planting strips can do much to erase the undesirable features common to such uses and, when further separated by major traffic streets, sufficient isolation can often be obtained. Many small and light industrial activities find location on highways more advantageous than on railroads or water transportation, since most of their material is received, and their products shipped, by motor carrier.

Commercial Area

The past practice in subdividing has been to allocate most of the land abutting major traffic thoroughfares to commercial property, which has resulted in great excesses of such property, poorly located. It is possible by means of service roads and planting strips to screen out the objectionable features of traffic so that the property is adequately suited to residential use. Commercial property should be grouped, rather than platted in strips. Such groupings to provide for neighborhood uses will be sufficiently convenient if located at points one mile apart, generally near intersections of major traffic streets. The amount necessary can be closely approximated by estimating the type of retail stores necessary by proportioning the estimated total purchases. A general rule found to be reasonably accurate allows four inches of commercial frontage per person of population in its sales area for suburban requirements. Not more than six inches per person should be platted for the entire city, including the central business area. This is the average in use in large cities throughout the country.

Local Commercial Areas

Such areas should be located on or just off the main highway or highways. Highways should be widened at such points unless parking is otherwise provided. Servicing of such uses should be separated from parking facilities, and alleys should be platted for such servicing. The average depth of the neighborhood store is less than 80 feet and generally they are in units of 20 feet in width. The trend has been to larger units but there appears to be no reason why the unit for commercial property need be changed from the 20 x 100 feet in common use today when parking and servicing facilities are provided otherwise. It is desirable, however, that integrated commercial centers be provided for, with all individual units correlated to the whole. When such is possible the individual units can be platted to suit convenience. Architectural control is desirable, although sufficient legislation for such control by public bodies does not generally exist. Neither has this type of control been classified as a police power.

Residential Property

Platting of identical residential lots is not recommended. All the varieties of shapes, sizes, views, and topography within the limits of the subdivision possibilities should be made. Natural features such as watercourses, trees, and hills should be preserved, and by so doing the development costs of the subdivision will be kept to a minimum. Small lot sizes and irregular unusable shapes are not recommended. Depths greater than 150 feet as a general rule are wasteful and widths less than 50 feet leave little space for the side yards necessary for free circulation of air and the admission of light. The size of the lot will vary with the class of subdivision, and with the income of the group which will constitute the purchasers of the lots. The market for lots should be carefully estimated and lots provided to fill the market. Six to seven thousand square feet per lot is generally considered adequate for the average single detached home site, since this represents about all the land that can be taken care of by the occupant. As nearly 50 per cent of all urban residential land is still vacant, little justification can be found for platting small lots without some individuality.

Lots should also increase in size as the distance to the urban center increases. While utility costs increase with the width of the lot, much of this is offset by the other advantages of width. Lots platted on cul-de-sacs escape the cost of sidewalks and wider paving. Lots in-

tended for persons with large incomes should usually be treated individually since cost is not a major item to consider. Corner lots should be 10 feet wider than interior lots to provide the set-back necessary on the side street. Lots should not run from one street to another because of the opportunity offered for two frontages and encouragement for more than one dwelling unit. Lot lines should be perpendicular to the street lines.

Public Space

Land should be provided for public and semi-public uses such as schools, churches, community centers, libraries, fire and police sub-stations, playfields, and parks. If the cost of this land is distributed over the subdivision originally, and included in the sale price, the cost will be little different than later acquisition by condemnation. Also, the cost may become excessive if acquisition is delayed too long.

Schools

Location of schools and land area requirements can be anticipated. Kindergarten and elementary schools can serve only those children within a half mile, or, expressed in another way, an elementary school will provide for the children of from 500 to 700 families. The travel distance and families provided for should be balanced according to density of population. Not less than 5 acres should be provided for play space in addition to land required for the school. Junior high schools can serve an area found within a circle of 1 to 1½ mile radius and should have not less than 10 acres of play space in addition to the land required for buildings. High schools can serve the same area but, because of additional athletic requirements, playfields of 20 to 40 acres in addition to that required by the buildings should be provided.

Playfields

Neighborhood parks of from one-half to two acres should be provided in each area included within a circle of one-quarter mile radius. This can often be accomplished in cul-de-sacs platting by providing such play space in the irregular-shaped land left at the rear of the lots facing the end of the cul-de-sac, and can often include land not suitable for residential sites. These playfields should be primarily for the youngest age group. Where playfields are not included in the school site, an equal amount should be provided elsewhere; however, to have

them in conjunction with the schools saves duplication of equipment and space. The school serves as a community center. Should the subdivision be large enough to include area within a 2- to 3-mile circle, a 40-acre playfield should be provided in which can be located baseball, softball, football, outdoor gymnasiums, drill fields, swimming pool, skating, tobogganing, buildings providing for gymnasiums, dramatics, club rooms, movies, swimming pools, parties, and other social activities.

PARKS

The burden of providing parks belongs to the subdivider as much as to any public group. Parks are definite assets and should be incorporated in the original plan. Their inclusion helps in the sale of lots, and the apparent loss in revenue is offset by the increased value of all lots when parks are provided. Water frontage subject to flood is adaptable for parks and its platting into lots for private use should be prohibited. Not less than one acre of park land should be provided for each 500 persons and should provide natural features not customarily available to the urban resident. They may include playgrounds when of sufficient size and should include irregular topography, watercourses, and forests. No definite size of park can be recommended; however, one containing less than 25 acres would be very limited in facilities. Strip parkways, varying in width from the width of a boulevard to 500 or 1,000 feet, extending radially from the center of the city, provide necessary undeveloped natural spaces and isolation from objectionable features. They lend themselves easily to extension and offer many possibilities for the provision of park facilities to all sections of the urban development. Connecting parks by means of boulevards or parkways should be encouraged. Since parks generally extend over a larger area than can be provided in one subdivision, a plan correlating the park land should be made and adapted so that piecemeal acquisition, as land is subdivided, will accomplish the larger park.

A Model Contract for Street Lighting Service

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(Chairman of the Committee on Public Lighting*)

PROBABLY the oldest form of street lighting was the lamp of the town crier who walked the streets serving as a dispenser of news, giving the time, and acting as night watchman, as well as using his lantern for general illumination. From this point street lighting, at least in this country, developed through the stages of oil lamps mounted on posts or in front of houses, to gasoline vapor lamps, acetylene gas lamps, and gas lamps; then through the various developments of the electric lamp for street illumination, starting from the old open arc lamp and progressing to the enclosed carbon arc lamp of both direct current and alternating current design, to the so-called flaming arc lamp and magnetite arc lamp of both the pendant and inverted styles; and then through the different stages of the incandescent lamp with all of its associated and related equipment that is used practically everywhere in street lighting in this country today. While it is true that in recent years there has been some progress made in the so-called cold type of lamps, such as the sodium vapor, mercury vapor, and other fluorescent types, these are still in an experimental stage and have not been widely employed for street lighting in this country.

It is unfortunate that the progress of the engineering science of street lighting has been dominated to a large degree by a number of factors other than pure engineering and economics. Street lighting systems in a large majority of cases are quite like Topsy in the old story, who "just grew." Street lights were installed at locations dictated by factors other than engineering. As a result, the street lighting systems of most of our communities, and even of the larger cities, today

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represent not a coordinated system of scientific lighting, but a hodge-podge of lighting units, many of which were installed at locations without much regard to the engineering factors having to do with the installation as a whole.

Unfortunately, fad and fancy have entered into the design not only of the lighting units, but of the poles and necessary auxiliary apparatus. Sometimes the systems and equipment were so plain and severe as to be objectionable on the grounds of appearance. In other instances, ornateness was carried to a point where it interfered seriously with the efficiency of the system. The manufacturers are not entirely to blame for this condition. Competition forced them to subscribe to the whimsical desires of individuals and communities who wanted special and distinctive pieces of equipment. One large manufacturer lists 15,000 combinations of street lighting fixtures; and another states that the engineering files of the company contain over 200,000 drawings on street lighting items alone, actively carried for manufacturing reference.

In the United States the private utility companies furnish by far the greater part of the street lighting service, and the rates vary widely in different parts of the country for the same candle-power lamp. This condition is brought about largely by the conditions set forth above—the lack of standardization of equipment and the tremendous amount of so-called special installations. I am not advocating a universal standard, neither am I Utopian enough to feel that street lighting can for a long time be placed on a 100 per cent scientific engineering basis. There are many factors—political, economic, and operating—that require deviations from a so-called standard plan of lay-out. Every town and every specific job requires thorough study and, in my opinion, many times a compromise, if the best results, considering all factors, are to be obtained.

It seems to me that a common-sense approach to street lighting should contain the following elements:

1. A base or fundamental plan for lighting the community should be developed.

2. This master plan should be flexible enough to permit adjustments to take care of special conditions, such as political aspects, peculiar geographic conditions, unusual night accident points, and the other factors so transient in character that they cannot become part of a fixed plan.

3. The annual street lighting budget of the community should pro-

vide for a systematic annual growth and review of conditions so that the older parts of the system can be constantly revised and improved and the needs for additional street lighting cared for.

4. A contract should be developed with the supplier of the street lighting service that calls for a minimum number of lamp sizes, a minimum number of types of fixtures, a minimum number of pole designs and accessories, such as brackets, mast-arms, and other special equipment.

5. The contract should be simple and short. In addition to the specifications for the equipment itself, the contract should include a definite commitment on the part of the supplier of the service on the following items:

a. Time required to install new lights

b. The frequency of night inspection

c. The frequency of cleaning

d. A schedule for lighting and extinguishing the lamps

e. A statement to protect the purchaser on the trimming of shade trees. This item must be so worded that it is mandatory that the contractor do sufficient shade tree trimming to permit the most efficient use of the light from the lamps, and at the same time to protect the community against unscrupulous wholesale pruning of shade trees.

f. A method of reporting and an agreed-upon rebate for lamp outage.

While all of the aforementioned points are important and necessary, it is my feeling that the so-called part rate, as described in the following paragraphs, is an important innovation in street lighting contract practice. It has been used in a number of different parts of the country with almost universal success. The make-up of this type of rate is briefly as follows:

1. Lamp charge
2. Fixture charge
3. Bracket or mounting method charge
4. Poles
5. Underground supply equipment

Under the first item—lamp charge—should be included the current for the particular size of lamp, and the lamp re-trim item in the case of arc lamp electrodes. Thus a lamp of a certain size would carry a fixed charge per month, which would not vary whether the lamp was mounted in the least expensive or the most ornate housing.

Fixture charge would include the necessary transformer or com-

pensator and any such other device as would be a part of the housing for the incandescent lamp or other type of lighting fixture under Item 1, and would include the necessary maintenance.

Under brackets would be included all types of brackets used as standards on the system under consideration. This item would also include painting and replacing.

Poles would cover rental for the poles and also the various types of poles used in the general lighting system, as well as those used for bridges and boulevard lighting, and any other poles that would be used for lighting, or partly for street lighting and partly for other purposes.

Under the division of underground charges would be included various rental items for duct occupancy, junction boxes, cable, and other items that are a part of the underground structure. There is also an additional item which should be included—a charge for the removal or replacement of the equipment which it is desired to retire. Because part of a street lighting set-up will frequently include equipment still having an appreciable amount of unamortized life, this is a very large item. It is unfair to require the service company, without compensation, to make the many types of changes demanded and this item should be included in the street lighting tariff.

The following paragraphs have been extracted from a large utility company's filed tariff and the parts are shown here for the purpose of illustration.

RATE

The gross monthly bill for street lighting service shall be determined in accordance with the following unit charges:

LAMPS

Series Incandescent lighted every night from dusk to dawn	1,000	Lumen	(100 c.p.)	$1.40
	2,500	"	(250 ")	1.90
	4,000	"	(400 ")	2.30
	6,000	"	(600 ")	2.90
	10,000	"	(1,000 ")	4.00
	15,000	"	(1,500 ")	5.40
Multiple Incandescent lighted twenty-four hours every day	200	Watt		3.20
	300	"		4.60
	500	"		7.30
Series Arc lighted every night from dusk to dawn	4.0	Ampere,	Pendant	4.40
	6.6	"	"	6.90
	6.6	"	Inverted	7.60

The rate for 4.0 ampere arcs applies only to lamps now in service; no additional lamps of this type will be installed. Additional arcs of the 6.6

ampere type will be installed only if suitable facilities are available. Unit charges for arcs cover the lamp and fixture assembly.

Fixtures		*Type A*	*Type B*	*Type C*
F-1	Radial Reflector	$0.30		$0.55
F-2	Angle Reflector	0.40		
F-3	Red Globe	0.40		0.65
F-4	Small Pendant Globe	0.75	$0.80	1.00
F-5	Large Pendant Globe			1.20
F-6	Crown Globe	1.15	1.25	1.30
F-7	Lantern	1.05		1.20
F-8	Small Globe Reflector	1.20	1.45(C)	1.50
F-9	Small Globe Refractor	1.40	1.65(C)	1.70

Type A—without current coil *Type B*—with compensator
Type C—with transformer

(C) Indicates change or addition.

Brackets		*Single*	*Double*
B-1	Mast Arm	$0.15	
B-2	Pipe Bracket	0.20	
B-3	Curved Arm	0.25	$0.30
B-4	Curved Arm with Capital	0.40	0.50
B-5	Scroll Bracket	0.25	
B-6	Scroll Bracket with Small Torch	0.30	
B-7	Scroll Bracket with Large Torch	0.35	
B-8	Fifth Avenue Bracket		0.55
B-9	Knee Brace Bracket (4 ft.)	0.25	
B-10	Husk Bracket	0.40	0.60

Poles		
P-1	Wood, on private property	$0.25
P-2a	Tubular Steel, Trolley Type	0.65
P-2b	Tubular Steel, Boulevard Type	1.00
P-3a	Smooth Steel, 7.5 in. by 20 ft.	0.60
P-3b	Smooth Steel, other standard sizes	0.70
P-4a	Fluted Steel, Railing Type	0.45
P-4b	Fluted Steel, standard sizes, with small base	1.00
P-4c	Fluted Steel, with medium base	1.15
P-4d	Fluted Steel, with large base	1.80

No charge is made for wood poles, except those on private property, or for tubular steel poles, trolley type, used jointly for street lighting and the support of trolley span wires.

Underground Supply Lines	
Duct or Conduit, per foot	$0.010
Lead Covered Cable, per foot	0.003
Parkway Type Cable, per foot	0.008

Junction Box, standard type	
Installed subsequent to the effective date of this schedule....	0.500
OVERHEAD SUPPLY LINE EXTENSIONS	
First 400 feet of circuit per lamp	No Charge
Each 10 feet or fraction thereof of additional circuit	. 0.015

In offering these ideas of a model street lighting service, I feel that most of the features of a part rate have been covered, and I hope that this illustrated rate will be helpful in the attempt to effect standardized methods and practices in this country. Such standardization should make it possible for the municipalities who are purchasing street lighting to enjoy cheaper rates. It will also be helpful not only to the manufacturers of street lighting equipment but to the different utility companies who are in the business of supplying this service. It is only by a more universal standardization of practices that such a program can ever be achieved.

Most of the suggestions presented in this report are being practiced in Pittsburgh, and experience, based on a number of years of operation, has indicated that the arrangement has been advantageous to all parties concerned.

Progress in Sewerage Science

ALBERT P. LEARNED

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(Chairman of the Committee on Sewerage and Sewage Disposal*)

IT SEEMS appropriate at the end of a decade to touch on the advances in sewerage facilities and science during this ten-year period as well as to review the progress of the past year.

Improvements during the decade include the initial installation of sewerage facilities in many communities, the building of many more

* COMMITTEE ON SEWAGE DISPOSAL, 1940

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sewage disposal plants, particularly in such large cities as New York, Chicago, Buffalo, Minneapolis, Saint Paul, Atlanta, Denver, Columbus, Cleveland, and Detroit, and the extension and improvement of existing facilities. The P.W.A. grants and loans and W.P.A. grants in recent years have given a real impetus to the construction of sewerage facilities.

The public has been effectively educated during the last ten years to realize that the sewer system is a utility and requires proper operation and attention as much as do other utilities. The cost of operating a modern, complete sewage disposal plant has brought to the fore the need of funds for operation, and many cities provide these funds, as well as money for construction, by means of sewer rental charges. This Association has contributed materially to the clarification of the sewer rental problem by collecting, analyzing, and publishing the results of its study of this current practice.

The chief developments of this decade were the perfection of equipment to insure the more rapid, more complete, and more effective stabilization of sewage wastes. These developments followed those of the prior decade in which heated digestion of sludge, particularly in separate tanks, was introduced, activated sludge design and operation were improved and better understood, and chlorination was made more effective by greater appreciation of its function in sewage disposal.

Several innovations were introduced during the past decade, including installations of magnetite filters at Minneapolis, Denver, and a number of other points. Magnetite filters of two types have been installed, the downward flow and the upward flow. These filters in some localities have been in operation for more than a year and indicate considerable flexibility. They have been used following primary settling, and at Cleveland for straining trickling filter effluent.

Chemical precipitation has been brought to the fore very decidedly during these ten years and the representatives of a number of patented processes have very actively advocated their use. The installations to date have not conclusively proved one particular method superior to all others, nor that a particular chemical method is superior to all other types of disposal of equal cost.

The use of sewage gas as a source of power to provide the necessary auxiliaries about the plant has been much more general during the last decade. (This Committee has in process of preparation a report on the utilization of sewage gas.) The high rate trickling filter

was introduced during this period and research has indicated that it is adapted for use in treating certain strong sewage. The market for by-product sludge has been extended and a number of methods for disposing of sludge by incineration have been developed.

A problem that developed during the last decade has been how to control the load on the sewer system resulting from the installation of air conditioning equipment. The question has been answered in part by developments in the art, by which the cooling water discharged into the sewer has been materially reduced.

In the earlier days of sewage disposal the bacterial function was generally understood but often the by-products of such reactions had an adverse effect, sometimes resulting in a nuisance almost as bad as the condition prior to treatment. This situation has been materially improved by the use of equipment and methods planned to carry the various processes to the point of maximum efficiency without detrimental after-effects.

The year 1939 resulted in some developments of general interest, including a study of flocculation without chemicals, reported to have increased the removal of suspended solids, particularly in strong sewage. Flocculation has been accomplished by air, by paddle wheels, and by combination clarifiers and flocculators. Where chemicals are used, the mechanical flocculation is essential and the results correspond to its use with chemicals in water treatment.

The new Tallmans Island Sludge Plant, built by the City of New York, has installed 3500 H.P. gas engines, the largest installation of engines in this country. This source of power in the more complete plants materially reduces the cost of operation of such plants.

It has not yet been determined just how effectively garbage can be digested with sewage sludge without introducing some other complication in the normal processes of sewage waste stabilization.

It is noticeable that this year, as well as in other recent years, no new processes for disposal have been developed but rather modifications and improvements have been made in the processes already in use.

The Economics of Sludge Gas Engines

MORRIS M. COHN

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(Member of the Committee on Sewage Disposal)

WHEN THE members of the Committee on Sewage Disposal of the Association were canvassed during the forepart of 1939 to determine what problem of sewerage or sewage treatment most required the study of the Committee and the attention of the entire Association, one problem seemed most deserving of being placed on the agenda—the problem of gas engine economics. It was, therefore, deemed best to initiate a study of this problem of modern sewage treatment in the hope that the Committee could gather and collate data which would best serve to guide the thinking of public works officials along the many aspects of design, construction, operation, and business management affected by the process of gas utilization.

As the subcommittee looked objectively into this field, and began consideration of the factors involved in a study of gas engine economics, it became evident that even with every member of the Committee functioning effectively, it would be impossible to do more than scratch the surface of the subject in time for publication of an annual report in the 1940 edition of the Yearbook. It was determined to continue this assignment into 1940 in the hope that the Committee could make some contribution to the proper engineering and economic approach to this problem before any report is placed on record with the Association.

This will serve, therefore, as a statement of the intention to continue the committee study, to the end that better light will be shed on the question, "Does the production of power from sewage gas pay?"

The use of by-products of processing has become synonymous in the public mind with industrial efficiency. Similarly, the utilization of by-product gas from the digestion of sewage sludge appeals to the dramatic sense of the public at a time when public approval of modern sewage treatment is essential to the ultimate solution of our stream pollution problem.

The very nature of the biological transformation of sewage solids into digested sludge, with the production of sludge gas with valuable BTU's, has led to the use of the generated gas for the production

of heat with which to develop optimum digestion temperature conditions. Thus was developed the method of using gas for digester heating.

Aside from the dramatic effect on the public imagination, the harnessing of sludge gas for the production of power has attracted the attention of the sanitary engineering profession. The complexity of the modern treatment plant, with its power-using mechanical processes, has naturally led the engineer to look for a cheap source of power to operate the equipment with which he has supplanted manual methods. The gas engine, originally developed for use with other fuels, has been converted into effective units for changing BTU's into KWH's.

Many modern plants are demonstrating the ability of gas engines to supply all or a major part of the power required. How efficient are they? What is the cost of installation, operation, maintenance, and replacement? What are the records of service in the plants where gas engines have had sufficient time to prove their merits? How does the gas engine affect the decision to digest sludge or to incinerate undigested sludge? Is the gas engine economical in small as well as in large installations? In short, what are the economics of sludge gas engines?

Here is a problem of engineering and economics which is truly in tune with the advanced state of the science of sewage treatment. Sewage treatment is a public utility; its methods and results should pass the tests of engineering efficiency and economic sense. A study of the economics of the gas engine should do much to enlighten the field, answer the questions of the public works official, and establish fundamental knowledge which may help to guide the decision of engineers to utilize gas for power. In view of the relationship between gas engine use and sludge disposal processes, the problem becomes one which has bearing on the entire scheme of modern sewage treatment.

Fortunately, there is a sufficient backlog of dependable information upon which to base a study of the nature contemplated. Many sewage works have authentic records of operation and upkeep costs, as well as the amount and value of the power generated from sludge gas. Gas engine manufacturers have become fully conversant with the needs of the sewage treatment field and have available basic data on the economics of equipment particularly designed for sewage sludge gas and sewage plant power needs. Furthermore, committees of

other technical societies probably have contributed material which should be of value in this study and current technical literature should be rich in references.

The Committee will appreciate the contribution of data on equipment used, and upon operating results obtained in connection with gas engine installations, and these data should be sent to Morris M. Cohn in Schenectady, New York, who is directing the preparation of this report by the Committee.

The ABC's of Sewage Treatment

MORRIS M. COHN*

Sanitary Engineer, Schenectady, N. Y.

IT IS as difficult for a sewage man, who for twenty years has been figuratively and practically immersed in his subject, to deal with the basic essentials of this subject as it is for a woodsman to "see the forest for the trees." In the complex changes which have overtaken the treatment of sewage, we have been in danger of losing sight of the simple aims and purposes of this phase of municipal service; in the astounding momentum of our progress, we have need for a simple recounting of our problem, for a simple inventory of our purpose and of the mechanisms with which we hope to accomplish our task.

It is well, therefore, for those who are fully conversant with the field to review retrospectively the ABC's of sewage treatment, just as it is refreshing and reassuring to reread an old book which has become a familiar friend.

Yet, this desire to reintroduce you to an "old friend" cannot excuse the inclusion of this elementary discussion in the crowded program of a workaday, forward-looking Congress. It is of even greater importance to introduce to officials who have not previously considered the problem this municipal function which lies just ahead for every city in the United States.

Here, then, is the important function of this discussion—to acquaint you with your sewage treatment needs and the devices for the satisfying of these needs. It is a real responsibility, therefore, to say to you:

* In Mr. Cohn's absence, his paper was presented by Samuel Greeley, Consulting Engineer, Chicago, Ill.

"Meet sewage treatment; you two will see more of each other, I am sure."

In our efforts to educate the public to the need for sewage treatment, we have forgotten to educate those who should teach. We cannot expect to convince the tax-paying public until their officials are themselves fully conversant with the facts, and conduct themselves so as to gain the confidence of their constituents in the cause of stream cleansing. A rejection of a sewer or sewage treatment bond referendum by the public does not reflect discredit on the voters; it merely indicates the inability of unconvinced officials to convince those whose interests they serve.

Striking demonstration of this simple truth was recently given in New York State where health authorities are endeavoring to return the stately Hudson River to a reasonable degree of civilized decency and sanitary safety. To this end, the communities along this stream have been notified to remove untreated sewage from the river by 1940.

While many cities have intelligently initiated interception and treatment programs, others have spent valuable time and energy in wrangling over the edict and attempting to gain support from other cities in their efforts to delay the stream-cleansing program. These efforts have not come from private individuals, but from the officials who should have been the first to recognize the benefits of sewage treatment.

Almost impertinent was a request sent by one city to the governor, speaking also for other river cities, asking him to "use his influence" with the health commissioner to set aside the enforcement of the public health law. Even bolder was the attempt of some cities to obtain an expression of opinion on pollution elimination from gubernatorial candidates at the past election, as though the outcome of the election might determine their attitude toward the health department edict.

What is needed is education of public officials in the significance of sewage treatment. In a simple introduction such as this, it is necessary to hurdle many details, to make sweeping generalities, to take certain liberties with scientific accuracy, and to make sewage understandable. If you find the ABC's of interest, you can obtain more advanced knowledge from this field which has clearly demonstrated its anxiety to share its data with public works officials.

It has been said that sewage treatment is the most modern function of the modern municipality. We hear much of street lighting, of

street cleaning, of the proper disposal of rubbish and garbage, of water supply systems. However, these functions are old compared to the newer task of the treatment of municipal sewage. No doubt primitive man, when he dragged his unwilling mate back to his cave, lighted his way with the first type of street lighting, the torch. Moses was the first advocate of decent refuse disposal. The roads that led to Rome had to be cleared of debris and repaired. The Greeks had a name for the grafter who made illicit connections to the aqueduct-fed water mains of the city. But sewage disposal—this is a new story.

What Is Sewage?

Sewage has been defined as the liquid waste of community life. It has achieved this definition by the process of human urbanization. When man lived a simple life, the wastes of his life were spent upon the ground, where oxidizing agencies wrought their simple purification processes. When man settled on the land he chose the old back-house as the repository of his wastes.

The structure eulogized in poetry by James Whitcomb Riley, and in prose by the inimitable Chic Sale, hardly is in keeping with the needs of the modern community. The massing of millions would be impossible were it not for modern methods of freeing man from dangerous, inconvenient, and revolting contact with the wastes of his life. The modern community has, therefore, provided an ideal method of performing this function.

When our forebears ceased jiggling a pump handle to obtain their water and moved to the city, they substituted the faucet for the pump. However, the supplying of water to the home is based on the ability of communities to remove the "spent" water from the homes. The modern community can not permit the practice of discharging waste water into the streets via the aerial route as was done in the dark Middle Ages. Today, every modern city has a network of conduits reaching into every street of the community and giving each structure the opportunity of connecting its wastes to this necessary conduit.

These sewers carry the waste water of the home, the commercial establishment, and the industry, together with the wastes of living and of industrial processes—or, in short, *sewage*. With community waste waters averaging over 100 gallons per capita per day, the liquid flow becomes a staggering figure in comparison with which the national debt is trivial. It takes little imagination to realize that most of the water which enters the home leaves it in the form of sewage.

Similarly, our vast industrial system requires water for the successful completion of manufacturing processes, and these wastes eventually find their way into sewers or into nearby streams. The proper treatment of industrial wastes, either along with or mixed with sewage, is one of the pressing sanitation problems of our time.

Strikingly, the character of the sewage reflects the life of the community. Every act of home life, every process of industry, is reflected in the quantity and quality of the sewage flow. Sewage is a by-product of life; it is but natural that this material should mirror the conditions of life. It reflects the big changes, as well as the trivial. The glorious rise in the standards of living, the sweeping revamping of the industrial world, the restrictions of a constitutional amendment, the pinch of depression—all are reflected fully as exactly as the home canning operations of the housewife.

The human wastes, the wastes of physiological existence, are but one constituent of sewage. The waste water from the home serves as a catch-all for all material which the housewife has deemed capable of being carried through the plumbing system. The kitchen sink delivers a motley mixture of kitchen-operation wastes; the laundry tubs discharge dirt, lint, soap, patented and highly advertised cleaners, gasoline cleaners, and other wastes; tubs and showers contribute bodily dirt, soap, and bath salts, not to mention reducing salts. The toilet contributes a mixture of materials which stagger the imagination. Millions of pounds of scouring powder go down the drain as a tribute to the persuasiveness of national advertising. It is no exaggeration on the part of the sanitary engineer when he says that sewage contains "everything but the kitchen sink."

In spite of all of these wastes, sewage is a dilute liquid. Seldom does the average American domestic sewage contain more than 1/10 of 1 per cent of total solid matter and seldom does it contain more than a few hundredths of 1 per cent of visible suspended solids. The ability of the tremendous volumes of waste water to dilute the community wastes and to carry them by water buoyancy is the basis of successful sewerage practice.

Indicative of the sanitation progress of the time is the new trend toward harnessing the water-carrying power of sewage to transport properly ground fresh food-wastes from the home, and its admixture with sewage to produce a combined municipal waste which is capable of treatment in modern sewage treatment systems. Indicative of the unselfish research in the sewage field are the studies which have been

devoted to proving the feasibility of the joint sewage-garbage disposal process.

Sewage Treatment

The minute amount of foreign matter mixed with the waste water of the community in no way measures the danger of the material. These wastes have taxed the ingenuity of engineers in devising methods for returning the liquid to its non-injurious condition. The task is about as difficult as all the king's horses and all the king's men must have found it to put Humpty-Dumpty together again. This process of removing from sewage its "power for evil," prior to its discharge into a watercourse, constitutes the process of sewage treatment.

Many proposed methods for making a sparkling liquid from sewage lie strewn along the path of sanitation progress. Much effort has been applied to the task of converting "spoiled water," or sewage, into the pure liquid which communities need for their teeming millions. Methods of sewage treatment have become more complex as the nature of the polluting wastes has become more complex and as we have learned to know more about the dangers that lurk in the turgid waters that emanate from our life processes.

The forked stick, which Moses admonished his followers to carry with them for disposal purposes, has a modern counterpart in some sections of the Orient, where human wastes are the medium of exchange and the wastes of the upper classes are more valuable as a fertilizer because of a better balanced diet than is consumed by the rice-eating coolie. Yet, modern peoples shun contact with such wastes and must willingly spend large sums to remove these materials from their environment and convert them into harmless form.

The degree of sewage purification needed by a community varies with local conditions. The proximity of water supplies, bathing areas, or shellfish breeding grounds, amounts of diluting water available in the streams, the value or significance of the streams for historical or recreational purposes, all affect the amount of treatment required by the sewage prior to discharge.

Sewage contains three objectional constituents which make it essential that this material be properly treated before it is discharged into watercourses: (1) The visible suspended solids must be removed if they are not to float on streams or settle along banks and on the bottoms to form putrefying masses of sludge; (2) the dissolved organic matter must be oxidized if this material is to be prevented

from putrefying and causing objectionable odors and destruction of fish life; (3) the millions of harmful bacteria must be either destroyed or reduced in numbers if pollution of water supplies, bathing areas, and shellfish areas is to be prevented.

It is the function of this simple review to explain the basic processes utilized for the removal and conversion of these dangerous constituents. It is impossible in this short introduction to describe the many interesting chemical and mechanical processes which are today being utilized.

Removal of Sewage Solids

It is evident that the wastes of life and living contribute to sewage large quantities of visible suspended solids. These materials may consist of small quantities of ash, of sand, and light inert materials and such solids as human feces, remnants of food, soap wastes, lint, and such other materials. Similarly, the size may vary from large pieces of solids to very small material, only a fraction of an inch in major dimension.

One of the major functions of sewage treatment is the removal of this solid material. One of the simplest methods of performing this task is by mechanical straining, just as the housewife may remove from her soup unwanted vegetables or just as we may remove from tea unwanted leaves by passing the tea through a strainer. For the removal of large particles, sanitary science has devised equipment called a bar rack or coarse screen. The simple flowing of the liquid wastes through such a screen removes from the liquid such large solid matter as becomes strained out of the flow. It is but natural that the removal of captured solids from such a screen should be entrusted to modern mechanical equipment.

Where the removal of this quantity of solid matter is insufficient to prepare the sewage for additional treatment processes, the sewage may be passed through finer screens which remove still more of the visible suspended solids. Such screens may have clear openings as small as a 32nd of an inch. Because of the rapidity of clogging of such fine clearances, it is usually necessary to provide mechanical screens for this finer straining process. Such screens may take the form of revolving drums or revolving discs, which alternately expose portions of the screen to the sewage flow and alternately move these portions above the sewage flow to be cleaned by brush or scraper mechanisms. The liquid discharged from such screens is freed from large particles of

visible solids, but contains appreciable quantities of solid matter which cannot be successfully strained from the flow. It is, therefore, necessary to provide additional methods for removing these finer solids from the sewage.

The screenings which are removed by either coarse or fine screens are disposed of in various manners. Perhaps the most elementary method is to dump this material upon the ground, to cover it with soil, or to deposit it in a prepared pit. Today, screenings are incinerated in specially designed incinerators or are finely ground by mechanical grinders to be left in or returned into the sewage flow for final removal by the same devices which remove the finer solids from the sewage. The removal of screening from the sewage, or its grinding, has many advantages. It may protect pumps and valves from clogging by large pieces of rag or sticks. It may prevent large pieces of floating material from passing into settling devices.

Mention has been made of the fact that certain inert materials or grit may be contained in the sewage flow. It is frequently essential that this material be removed from the sewage prior to ultimate treatment. The method utilized for removing this grit from the flow is typical of the classification process used in the ore industry.

The design of sewers is based on the principle that certain velocities of flow must be maintained in the sewer lines. In order to remove grit from the sewage flow without the removal of the organic solid matter which should be carried to subsequent treatment processes, so-called grit chambers or detritors are provided in which the velocity of flow is slackened to approximately one foot per second. At this velocity the grit is removed and the organic solids are maintained in suspension to be carried along by the sewage flow. The grit removed is processed or washed to remove organic matter and may be utilized for fill purposes. Ingenious mechanical devices are provided to remove and wash this grit.

The degreasing of sewage is effected by short-time floatation in skimming tanks and has been greatly improved by the separation of greases by aeration and aero-chlorination.

Removal of Solids by Sedimentation

Having removed from the sewage flow those solids which are capable of being strained from the liquid, or are capable of being removed at the reasonably high velocities which are maintained in grit chambers, it is essential to remove the large bulk of solids which still

remains suspended in the sewage. Just as grit was removed by slackening the velocity of flow to speeds which would settle out heavy solids, so the lighter organic sewage solids are removed by a similar classification process. When sewage remains quiescent, or nearly so, these solids settle from the sewage, leaving a relatively clear supernatant liquid. The principle is much like that involved when the Mississippi River, upon losing its velocity in the Gulf of Mexico, forms a delta at the mouth of the river.

There are many devices for reducing the velocity of sewage flow to such a point that sedimentation occurs. These are usually in the form of tanks through which the sewage slowly flows and into which the solid matter settles. The resulting clear liquid flows from the tank either to the diluting stream or to secondary treatment processes.

Perhaps the first type of settling device was the septic tank which still has a modern counterpart in the septic tank used in farm houses and suburban homes not connected with a public sewer system. In this tank the solids settle and remain in the bottom where they undergo decomposition. An advancement over the septic tank is the Imhoff tank, which is a two-storied tank, the upper compartment of which is used for the settling of the solids from the liquid and the bottom compartment of which is used for the digestion of the solids by bacterial action. A hopper-shaped partition divides the two compartments, the solid matter falling onto this hopper, sliding down the incline and falling through a connecting slot into the digestion compartment.

The newest settling device is the so-called plain settling tank of circular or rectangular shape. In this type of tank, the principle of sedimentation is exactly the same as in the septic tank and in the Imhoff tank. However, the solids which settle in the bottom of the tank are continuously scraped and concentrated by circular or longitudinal collecting mechanisms to a collecting sump and from there pumped to some point of further treatment.

In order to increase the speed and efficiency of removal of sewage solids, a modern method of chemical precipitation has been advocated and is being used. In this process, a coagulating chemical, such as ferric chloride or alum, is added to the sewage. This material produces an insoluble, heavy floc which adheres to the sewage solids, makes them heavier, and causes them to settle more readily in the settling tank. In addition to removal of solids which are capable of settling, the chemical floc converts the fine colloids into larger particles which can be removed by sedimentation.

Similar coagulation, without the use of chemicals, has been produced by the simple expedient of mechanical mixing. This agitation has demonstrated its ability to improve sedimentation efficiencies.

Filtration of Sewage Solids

We have seen how large solids have been removed from sewage by mechanical straining and how finer solids have been removed by sedimentation. We have also seen how fine solids, in the colloidal state, have been removed from sewage by means of chemical precipitation and mechanical flocculation. There are, in addition, many solids which are not readily removed by these processes, and it is essential that other methods be devised for removing these materials from the flowing liquid if a more highly purified effluent is to be produced. For the purpose of removing these more difficult solids, engineers have called into use the simple process of filtration, a process which is utilized frequently in the home and laboratory for the removal of sediment from liquid. Filtration of sewage may be effected by passage of the liquid through sand filters or through modern type magnetite filters composed of a shallow bed of magnetic iron ore. Filtration through anthracite coal has also been advocated and used.

It is interesting that settling tanks in a city of 100,000 population may remove as much as 10 tons of solids daily from the 15 million gallons of sewage produced by the city.

Oxidation of Dissolved Organic Matter

We have reviewed the methods utilized for the removal of the major objectionable constituents of sewage—the visible suspended solid matter. The matter in dissolved form is equally as objectionable from a sanitary sense, and the removal of this material is highly essential in many localities, because of slight dilution by streams, the possibility of nuisance and odor conditions, the dangers of destruction of fish life, and many other factors. Sewage contains large quantities of nitrogenous matter in a highly unstabilized form, having its source primarily in human waste. It is essential that this material be successfully oxidized into more stable forms in the sewage treatment plant so that this material, when discharged into the diluting stream, must not, of necessity, continue its transformation through the so-called nitrogen cycle, a procedure which requires large quantities of oxygen which is taken from the oxygen content of the stream waters. This robbing the stream of oxygen produces odors and other nuisances.

The major amount of suspended solid matter having been removed by means of screening and sedimentation, sewage is frequently passed through trickling filters, composed of stones, slag, coal, or other media, for removal of colloidal solids and the oxidation of organic matter. The sewage is distributed over the stone area by means of rather picturesque nozzles or by interesting mechanical distribution systems. The sewage then trickles through the stone bed, which is frequently six or seven feet deep, and by contact with oxidizing bacteria contained in the filter, the ammonias contained in the sewage are oxidized into nitrites and nitrates. The oxidized sewage is then capable of being discharged into watercourses without the danger of nuisance conditions, after settling of the filtered sewage has removed the humusy solids.

Today, bio-filters provide filtration of sewage at high rates, by return of the effluent to the filter inlet or clarifier, and the production of a highly oxidized final effluent which can be readily clarified into a clear liquor.

The trickling filter or bio-filter is not a mechanical straining device; it is rather a trained bacterial circus in which nitrifying bacteria produce an interesting chemical transformation of the nitrogen and colloidal solids.

The need for producing a highly oxidized and stabilized sewage effluent has led to the development of the so-called activated sludge process—a process which is in use in many large cities and a number of smaller ones. This process depends upon the contact of sewage with sludge which contains large colonies of nitrifying organisms, all in the presence of excess oxygen as furnished by compressed air through plates or by mechanical agitation equipment which keeps the sewage saturated with air. The oxidized sewage is then settled and the solid matter is readily removed from the liquid. The effluent from such a plant is clear and highly stabilized.

Removal of Bacteria

We live in constant fear of germs. Our interest in these unseen organisms is perhaps heightened by the fact that so few of us realize their significance or understand their characteristics. Just as earlier man attributed disease and death to mystic spirits, to the disfavor of the gods, and to such quasi-scientific principles as unbalanced blood and bile, so our present generation has learned to attribute its ills to germs.

Perhaps in no instance is this fear more reasonable than with sewage. Sewage contains millions of bacteria which have their source primarily in the human intestines. Naturally, many of these organisms are harmless. However, many may be the transmitters of disease of an intestinal or other nature. The discharge of sewage into watercourses has been known to result in the transmission of water-borne diseases for great distances. There are many classic examples of the transmission of typhoid from one community to another along the same watercourse because of the pollution of the water supply of downstream communities by the disease germs of the upstream sewage. Less spectacular, but perhaps equally dangerous, has been the transmission of dysentery and diarrhea.

It is evident, therefore, that one of the major functions of sewage treatment is the removal of the major amount of these harmful bacteria from the sewage flow. When it is realized that average American domestic sewage may contain as many as two million bacteria per cubic centimeter and that a centimeter is about 1/28th of an ounce, the enormity of the task becomes evident. In the sewage treatment plant, the removal of the solid matter by means of screens, by tanks, and by filters, results in a natural reduction in the bacterial content of the sewage. Furthermore, the filtration of sewage through trickling or bio-filters, or the treatment in the activated sludge process, results in a major removal of the bacterial content. In many instances, this quantity reduction in bacterial content is sufficient to suit the needs of the diluting stream. Where further sterilization is essential, the destruction of bacteria is obtained by the chlorination of the sewage. The addition of chlorine will result in the practical sterilization of the sewage and such sewages, after proper treatment, may be safely discharged into streams that serve as the water supply of downstream communities, or are serving as bathing and recreational areas of people downstream. There are numerous instances in this country where highly purified and sterilized sewage is entering watersheds of large communities.

Disposal of Sewage Solids

We have seen how large quantities of sewage solids removed from the flowing liquid were deposited in septic tanks, in Imhoff tanks, or in plain settling tanks. Some reference was made to the digestion of this material by bacterial action. Herein lies perhaps one of the most interesting phases of modern sewage treatment practice. There is

considerable romance in the process which converts the motley solids of human life and human living into an innocuous, humusy material called sludge. This transformation is performed by anaerobic bacteria, or bacteria which flourish in the absence of sunlight and oxygen. The process of sludge digestion is not dissimilar to the process which goes on, century after century, in swamp land. We all know how vegetation and animal life which has fallen into swamps is transformed by a slow process of decomposition into black swamp soil or humus. Sewage bacteria perform this same function upon the complex animal and vegetable matter contained in the sewage flow, and sludge is not greatly different from the swamp soil or humus which we use on our lawns and gardens.

While sanitary science has devised this rapid method for the digestion of sewage solids into a harmless material, modern sewage treatment has not been content to permit this leisurely biological transformation to run its course.

In the so-called separate sludge digestion process, the sludge deposited in settling tanks is continuously pumped to sludge digestors where temperatures are maintained at 85° F. or higher throughout the year, in order to produce optimum bacterial conditions and thus to increase the rate of sludge digestion. Actually, thermophilic or high-temperature digestion has been advocated and used, for the purpose of increasing the speed of bacterial digestion to a point where the transformation from sewage solid to digested sludge may take a matter of days rather than weeks or months.

The disposal of sludge has been one of the major problems of sewage treatment. The sludge removed from digestion tanks and from digestion compartments has the consistency of light cream, if not its color. Sludge may contain from 5 to 10 per cent of solid matter and from 90 to 95 per cent of water. It is essential to remove the major quantity of this water so that the sludge may be handled in the dry or semi-dry form. The moisture may be removed from sludge by means of sand drain beds called sludge drying beds. Sludge is applied to these beds to a depth of 10 to 12 inches and by filtration and evaporation dries to a cake about 3 to 4 inches thick, which can be removed from the beds by means of ensilage forks or mechanical devices. The dried cake may be disposed of as a fill or used as a fertilizer or soil conditioner.

Several communities are marketing this sludge to farmers and local householders, for use on all types of crops and for lawns and flower beds. The material is not unlike swamp humus and makes a satis-

factory plant food and soil conditioner. A number of cities have launched fertilizer ventures and are selling dried, ground, and even enriched sludge. The vegetables you eat, the golf course you play upon, the lawn you admire may owe its luxuriant growth to sludge. Thus we find ourselves, by a process of hygienic disposal of sewage, back to the principles which actuate the Chinese in saving human wastes.

When the drying of sludge on the sand beds is affected by weather conditions or may disseminate odors to nearby residences, these beds are frequently covered or surmounted by glass-overs like those used in greenhouses. This protection enables the drying of sludge to proceed during the complete year and without being affected by precipitation.

The age of Technocracy has left its imprint on the problem of sludge drying. In order to hasten the removal of liquids from the sludge, vacuum filters have mainly been used and centrifuges and spray dryers have been utilized. Actually, every dewatering device utilized in industry has been tried for the dewatering of sludge. Perhaps one of the newest trends in sewage treatment practice is the incineration of sludge cake produced either on drying beds, vacuum filters, centrifuges or in spray dryers. In these incinerators, the sludge is destroyed by high temperature incineration and the only residue of the sewage treatment process is an inert ash.

The ability to incinerate sludge into an inert residue has led to the process of destroying sludge by this means, without recourse to digesting the solids prior to final disposal. Effective incineration of dewatered raw sludge is a reality at Chicago and Detroit, for example.

Digestion of sludge produces a valuable gas which has many of the characteristics of marsh gas. It has a normal heat content of approximately 625 B.t.u. per cu. ft. and contains about 70 per cent methane and 20 per cent carbon dioxide. This valuable heat content is today being utilized for the production of heat and power in sewage treatment plants. The gas is being collected from separate sludge digestors, stored in gas holders much like the holders used in the gas industry, or in multi-stage digestors, and utilized for the operation of hot-water heaters and of gas engines which may be directly connected to generators, blowers, pumps, or other necessary treatment equipment.

The gas is used for the production of hot water which is circulated through sludge digestion tanks for the purpose of maintaining the temperature in these compartments at about 85° F. Here is an interesting instance of "perpetual motion." The digestion of sewage solids by bacteria produces gas; this gas is utilized for producing hot water;

this hot water is returned to the digestor to raise the temperature to a point which will produce more rapid bacterial digestion; the more rapid digestion produces more gas, which may in turn be used for the increasing of bacterial activity and the consequent production of more gas.

The utilization of gas is today making possible the operation of more complex and more efficient sewage treatment processes at an economical cost. Thus, sanitary engineering has stolen a page from the book of the power industry and is today raising the status of municipal sewage treatment to that of an efficient utility.

Beyond the ABC's

This is the simple copybook story of the ABC's of sewage treatment, presented with the absence of detail which is necessary in such an elementary review. It merely demonstrates that, for untreated sewage, *A* is for atrocious; *B* is for barbarous; *C* is for contaminated. It demonstrates, I hope, that for properly treated sewage, *A* is for attractive; *B* is for beneficent; *C* is for clean.

Beyond the ABC's are the intangibles which have made efficient and economical sewage treatment possible, which have raised this phase of public works from the realm of a despised, unwanted function to the state of a true public utility.

The foul, neglected plant is gone; in its place stands a works which is a public asset, which is an attractive neighbor, and an example of municipal progress. Intelligent operation by trained, licensed men, beautification of grounds, intelligent public relations programs, and rigid cleanliness and odor control, all have focused favorable public attention on sewage works.

Methods of financing sewerage and sewage treatment facilities have kept pace with the utility trend. Most states have legal machinery which makes it permissive to charge for sewerage services in the form of rental fees which guarantee sufficient funds to make these waste water facilities as self-supporting as water services. Many cities are successfully availing themselves of this financing method, with full public approval.

Stream pollution is dead—and legislation is helping to bury it. What enlightened public opinion has not yet done will be further performed by anti-pollution laws of states and the nation. New state laws have been placed on the statutes; old laws which were in need of good teeth have been fitted with dental plates which bite where biting is

necessary; two Congresses have labored over national pollution legislation and there is hope that some kind of unified policy will be evolved.

Sewage treatment, in the measure found necessary for the particular local conditions facing each community, is the solemn obligation of society. Each process of sewage treatment has its place. It is not a question of one against the other, as much as it is the intelligent choice of that process or combination of processes which will give the most public health protection for the fewest dollars of investment and continuing maintenance and operation. It is essential, therefore, for every progressive public works official to have a constructive grasp of the sewage treatment problems which lie ahead.

I bespeak the intelligent use of public funds through mature study of pollution control, through broad-gauged design, and through sensible supervision and operation by trained and experienced personnel.

It is the function of every official to practice the ABC's of sewage treatment: *A*nticipate your needs; *B*uild adequate works; and *C*ontrol operation.

DISCUSSION

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I NOTICED in the introductory statements of Mr. Cohn that he qualified himself for giving his paper as having been figuratively and practically immersed in his subject for some twenty years. I don't know whether he had in mind the hard-shell Baptist definition of immersion, which is thorough and complete, or whether it was a partial immersion. I can nearly qualify from the Baptist standpoint, and so far as sewage sludge is concerned I have been at least half immersed in it.

As I understand from what Mr. Cohn wrote when he sent me a copy of his paper, his object in this discussion was to give a talk to the public works officials who for the first time were charged with the construction and operation of a sewage treatment plant. I think I can qualify from the standpoint of a public works official, because I am a member of the Board of Water and Sewer Commissioners in the little town of Medfield, Massachusetts, which has the oldest sewage treatment plant in Massachusetts and I think one of the very oldest in the

country. It was built in 1876, and so far as I can make out practically nothing has ever been done to it from the standpoint of improvement or maintenance since it was started.

A large number of sewage treatment plants now under construction throughout the country will before long be completed and ready to be placed in operation for the purpose of removing pollution from streams, lakes, and other bodies of water. This inevitably means new responsibilities for many city officials who will be in general charge of the operation of these new plants. It is of great importance that these officials be advised of some of the operating problems which their new responsibilities in sewage treatment will bring them.

The efficient operation and suitable maintenance of sewage treatment plants are quite as essential to stream purification as good design and construction of such plants. It is probably no exaggeration to state that millions of dollars invested in sewage treatment have been wasted in the past as a result of the neglect of costly treatment works after construction. Fortunately there is a steadily growing appreciation of the need for trained supervision of operation of treatment plants, and increasing numbers of plants are being operated by technically trained men. Some states, in fact, require that plants be run by licensed operators.

If a sewage treatment plant is not managed efficiently, many unsatisfactory conditions may result. One of the first results of poor operation is deterioration in the quality of the treated sewage, or effluent, discharged from the plant. In fact, it is possible for a treatment plant to be operated in such a way as to produce an effluent which is no better than the incoming sewage. Inefficiently operated plants may cause annoyance to the public, due to obnoxious odors, the breeding of flies and rats, and the production of other objectionable conditions. The failure of sewage treatment plants to accomplish all the purposes for which they are designed often is due to combinations of poor management and inadequate funds for operation. One of the essential functions of officials charged with the operation of the plants, it seems to me, is to do everything they possibly can to see that they get adequate funds to operate their plants. They can't appropriate the funds but they can, through education and a struggle, do much to see that funds are appropriated.

It is becoming rather general practice for designing engineers to retain for one or two years consulting supervision of operation of new plants constructed after their designs. This practice is of benefit to the

municipalities because the engineers know the details of the plant, for what purpose they were included in the design, and how they are supposed to function. Usually the engineers have had previous operating experience with these plants which is of value in the "tuning up" of a new plant.

For small plants, where the funds available do not permit the engagement of a full-time, technically trained operator, the retention of consulting engineers to maintain general supervision of operation, with occasional visits to the plant, is distinctly advantageous. These occasional visits, together with the receipt of regular reports from the operator, permit the engineers to give operating instructions which, if carried out, will result in maintaining satisfactory performance on the part of the treatment plant.

In Massachusetts this practice has been carried on for over a quarter of a century in a number of very small plants where they can't afford to have anything above the intelligence of a common laborer as the operator, and yet those plants today turn out just as good effluents as they did when they were built. Most of them are old sand filters, which are quite common in that part of the country, and where the effluent is really a sparkling water.

In many states general oversight of the operation of sewage treatment plants is maintained by the engineering divisions of the state health departments. In certain states the health departments require monthly records of operation, while in other states they maintain regular inspection of plants. In Massachusetts samples of sewage and effluent from treatment plants are analyzed monthly. The thoroughness and efficiency of the oversight exercised are largely dependent upon the funds available for such service.

If a well designed sewage treatment plant is efficiently operated and suitably maintained, it constitutes a major contribution to the movement for clean streams. On the other hand, if it is not so operated and maintained, it may call down the wrath of the public upon the head of the responsible official.

Sewer Maintenance and Reconstruction

A Panel Discussion

CHAIRMAN POLK: The subject of sewer maintenance and reconstruction is to be presented as a panel discussion participated in by the gentlemen now before you. The cities represented are all in Cook County, Illinois, and are served by the sanitary district of Chicago, which relieves them of a disposal problem in so far as sanitary sewage is concerned, since this flow is picked up by interceptors and passed through the sanitary district treatment plants.

Our discussion will cover such points as maintenance and operation of sewer systems, catch basins and inlet cleaning, cleaning of sewer systems, handling of complaints, inspections, and so forth. These matters should be of vital interest to those responsible for the operation of sewerage systems in their cities. No one would question the necessity of keeping sewers, catch basins, and inlets clean, and yet this work is not always fully appreciated by the city officials in charge and in some cases it is neglected.

The other members of the panel are ROBERT L. ANDERSON, Superintendent of Public Works, Winnetka, ANTON PAV, Commissioner of Public Works, Berwyn, C. A. WALLS, Commissioner of Public Works, Oak Park, and JAMES A. WILLIAMS, Superintendent of Public Works, Glencoe.

It has been said that sewer cleaning work should be carried on in accordance with a predetermined schedule, including the inspection and cleaning of inlets, catch basins, sewers, and connections. In Evanston all sewers are inspected at least once every two years and the cleaning schedule is worked out based on these inspections. We have a large sewer map which is marked with a colored pencil when a sewer is cleaned. The use of a different color for each year gives a complete picture of the sewer cleaning work.

I want to ask Mr. Williams to give us his ideas on the matter of planning sewer cleaning work.

MR. WILLIAMS: It seems to me that you are unable to prepare your budget covering the operation of sewer cleaning unless you know what you have to clean. You won't know what you have to clean unless you have actually determined by inspection the length and size of the sewer in need of cleaning, in addition to the ordinary catch basins, and also the location of chronic sources of trouble.

I think we all have sewers to which we fell heir and which were improperly designed or constructed. There are other points along the sewer line where trees, such as cottonwoods and others of that type, cause a heavy root growth. It is necessary to locate these definitely, to treat them as special cases and give them more frequent cleaning than you would in the usual routine. We have found it advantageous to determine these areas, note them on our sewer cleaning map, and by yearly inspections of the areas where great root growth predominates make that the first step in our annual sewer cleaning program.

Also we devote a certain time of each year to the cleaning of our catch basin system. It has become so simplified that I hardly know what to say about it. It is just a matter of common departmental routine.

We know what it has cost us to clean, not per mile or per inch of sewer, but what it costs to clean an individual block or to take care of a certain sewer. It is impossible to determine in advance what it is going to cost per 100 feet per inch of sewer, because we have sometimes found what we thought was a simple sewer cleaning program was a reconstruction program, due to a breakdown caused by heavy root growth. Except for emergencies of that type I think it is quite simple to determine in advance the costs or at least the amounts of money you will spend in keeping your sewers clean.

CHAIRMAN POLK: Mr. Pav, have you anything to add to that?

MR. PAV: The only thing I can say to that is that we haven't been confronted so much with the cleaning of our sewers as we have with our catch basins. Our trouble is with leaves from the cottonwood and the poplar trees, gathering there.

We make periodical inspections and jot down the catch basins and inlets that need to be cleaned, so that when the frost is out of the ground and we can get down in the sewers, we can clean them out with our eductor.

CHAIRMAN POLK: Do you mean to say that in Berwyn you have no trouble at all with deposits in the sewers themselves?

MR. PAV: We have very little trouble with that. Of course we had some trouble when the Sanitary District came through with the intercepting sewer. They used a grouting machine and filled up our sewers with the grout. We had to go through with a drag and get the cement out of there. Sometimes we would get a telephone call from a home where the husband and wife were both working during the day and had come home and found their sewer and basement full of cement.

CHAIRMAN POLK: Doesn't that same thing often happen because of the operation of concrete mixers in the street?

MR. PAV: Well, we try to regulate that pretty carefully. Whenever there is a construction job of any kind going on we insist that the contractor flush the sewers properly during the day so that the debris won't settle in the sewer. It is carried on into the main sewers and we don't have any trouble.

CHAIRMAN POLK: You handle that matter by strict inspection?

MR. PAV: That is right.

I think the biggest trouble is that cities have been growing faster than the previous engineers figured on when they laid out the sewer systems. Now it is left up to the present engineers to remedy.

CHAIRMAN POLK: Mr. Walls, have you any ideas on the planning of sewer maintenance?

MR. WALLS: I am particularly interested in the gentleman's remarks with reference to planning a systematic method of sewer maintenance. It happens that in the Village of Oak Park, a town with approximately 72,000 population, their general attitude, or the attitude of the department I might say, has been somewhat haphazard toward sewer maintenance. The attitude has always been that what you can't see you don't have to worry much about.

In recent years there was a system of sanitary interceptors constructed, costing about two million dollars, which is being paid for on the sewer rental basis. It seems to me that the fact that we are collecting a sewer rental by the quarter puts a responsibility on the municipality that they did not assume before. I maintain that you are collecting a particular fee for a definite result. The result is, in our particular case, that nobody has a flooded basement.

I think in collecting that fee we now have a legal responsibility for possible damages in the event that we do have trouble with flooded basements which can be directly chargeable to negligence of sewer maintenance.

That brings me to the necessity for a systematic method of sewer cleaning which is not going to end at any time. Our system is designed to cover the entire community on an average of about once every two years. Added to that, of course, are the particular locations where trouble will occur quite often because of the gradient and other conditions that cause stoppages more often than at other places.

CHAIRMAN POLK: Would you care to add anything to that, Mr. Anderson?

Mr. Anderson: In our town we have worked out a little embellishment on your idea of the sewer cleaning map. We have a card index system. On a 5x7 inch card is entered a plat of about a block of sewer. On the reverse side is room for all the pertinent data, the time when it was inspected, the condition found. If it required any cleaning that is indicated by a colored flag placed at the top of the card. If it required flushing we put one color on, if it required dragging, another color. That file is turned over to the sewer foreman and he bases his operations upon what is indicated there.

We try to inspect the system at least once a year. We find in our case that because of dead ends or poor grades or other reasons we have a few spots that require flushing as often as once a month. Of course that is indicated on the card in another way.

Chairman Polk: How do you do the flushing? By fire hose?

Mr. Anderson: Yes. In a few cases we have a flushing valve incorporated right in the sewer, but they will not permit us to build those any longer.

Chairman Polk: Don't you think the tendency is to remove such devices?

Mr. Anderson: Yes.

Chairman Polk: In Evanston we had some fifty or sixty flushing valves and we have now about half a dozen. We find the work can be done just as well and more cheaply perhaps by the use of fire hose connected to a hydrant.

Mr. Anderson: We find the same.

On these cards are also entered data as to required repairs. If the bricks of a catch basin are falling out you can locate by another colored flag just where they should go.

Chairman Polk: It seems like a very good system. May I ask if you have had any trouble from the maintenance required by the attack of a concrete sewer by sewer acids? Our communities are largely residential and we may not have that trouble.

Mr. Anderson: We have not had that trouble, and in our case we restrict the use of concrete sewers to storm sewers. We have separate systems.

Chairman Polk: Do you have any of that trouble in Oak Park, Mr. Walls?

Mr. Walls: We have no industrial area to speak of. Ours is a combination sanitary stone wall system. The old laterals are all vitrified tile. However, the new construction is reinforced concrete.

CHAIRMAN POLK: I should like to ask Mr. Walls what department he thinks should be responsible for the cleaning of catch basins and inlets. Should it be the sewer department, as such, because these devices are part of the sewer, or should it come under the jurisdiction of the street cleaning department because it is part of the pavement system?

MR. WALLS: I think it should be a combined responsibility of the engineering department and the sewer cleaning department, very definitely, because there is a check by the engineering department on what is necessary for possible reconstruction. As far as the sewer department itself is concerned, the proper maintenance and operation of the sewer system is their sole objective. I think that if it is detailed to any other department it becomes a secondary proposition to that department.

CHAIRMAN POLK: And probably would be neglected.

MR. WALLS: In most cases. It has been my experience recently in checking around a great number of communities as to their general attitude toward sewer maintenance and cleaning that in 95 per cent of the cases the attitude is a haphazard one. They don't clean unless some particular trouble develops here or there. To me it is just as important to maintain and clean sewers to function in the way they were designed to function as it is to clean the gutters in the streets. That is not the general practice in our particular metropolitan area, as is evidenced by the outmoded type of sewer cleaning equipment that various communities have.

CHAIRMAN POLK: Mr. Pav, have you any idea as to where the responsibility for cleaning work should be?

MR. PAV: In Berwyn we have it divided. The street department is responsible for the cleaning of the catch basins and the inlets and the trap. If there is anything wrong outside of that it is up to the water department to get down to the sewer.

CHAIRMAN POLK: The water department takes care of the sewer maintenance?

MR. PAV: Yes. We have been working together very nicely. We have a Mr. O'Brien, who really grew up with the City of Berwyn, and he knows the sewer problem there. He doesn't even need the plat to tell what type of sewer there is in a given place and what type of equipment he needs to get down to it.

CHAIRMAN POLK: One of these walking encyclopedias.

MR. ANDERSON: What happens when he dies?

Mr. Pav: We have just finished a general survey of our sewer system by means of a W.P.A. project. We have that pretty well up to date now, so that in the event Mr. O'Brien should die we will have some records.

Chairman Polk: What do you think about this subject, Mr. Anderson?

Mr. Anderson: It really doesn't come up in my city, because it is a smaller city and the whole thing is under one head. I have charge of all the sewers and the streets and cleaning the basins, etc.

Chairman Polk: I believe that is also true of Glencoe, isn't it?

Mr. Williams: In the type of government we have in Winnetka and Glencoe the managerial office runs everything and there is no division of responsibility. We do combine the forces of the street department, the sewer department, and the water department in case of any emergency. All three of the departments are equally familiar with the sewer system so that at any time we can use any of the three departments as a complete unit and they will be able to do the work as if it were specialized in one department.

Chairman Polk: The three general methods of cleaning catch basins and inlets are eductor, hand, and machine bucket. Which method do you use in Winnetka, Mr. Anderson?

Mr. Anderson: Up to last year we used hand methods. I got tired of watching the boys stand around like W.P.A. crews on the street, perhaps getting out a shovelful every two or three minutes, and I evolved a machine-winch-handled clam bucket for this use. It has worked out rather well.

Chairman Polk: Would you mind describing that equipment?

Mr. Anderson: I'll be glad to. It is a one cubic foot clamshell bucket of our own design and construction, just large enough when closed, to fit inside the manhole cover or catch basin cover. Our covers are all standardized, as are yours. It is dropped closed into the basin, opened, loaded, and removed. It is mounted directly upon a standard dump truck body and is powered by a one and a half horsepower gasoline engine through a worm and pinion reduction arrangement to two small drums. It is a two-line bucket.

We have found that we have been able to operate it quite successfully and are getting good results. Our basins are cleaned once each year. Last year we cleaned about 1,100 basins, getting an average of one-third of a cubic yard of material from each one, and averaging about twenty basins per day with a crew of two men and a truck.

The advantage of the outfit, as I see it, is that it is comparatively inexpensive. We don't have a lot of money tied up in equipment. The truck is an ordinary dump truck used for regular street work. When the outfit is not in use we just swing it off and store it away.

I don't put this out as any substitute for perhaps more efficient and better equipment that is on the market in the way of eductors, but in the case of a small city I don't believe that the investment involved in such equipment is justified at all.

CHAIRMAN POLK: I believe that there are a number of these items of equipment that we can develop in our own departments.

How do you handle this work in Berwyn, Mr. Pav?

MR. PAV: As I told you, we are using the Elgin eductor. Of course where the catch basin has not been cleaned for some time we actually have to get down in there and dig it up. On the average, I will say that we can clean only about five catch basins a day. That is getting about three yards of sludge out of each catch basin. The cost is about $2.40 per catch basin.

CHAIRMAN POLK: You had an aggravated condition, no doubt.

MR. PAV: Yes. We had an election every two years and before you got your department organized they were out. Now we are operating on a four-year basis and we can accomplish something.

CHAIRMAN POLK: Do you use hand or machine methods in Oak Park, Mr. Walls?

MR. WALLS: We use the eductor method and thoroughly get over about 3,500 catch basins once a year with that one unit. There are certain parts of the district that have to have attention more often by reason of the application of cinders and sand during the icy weather and also the leaf trouble that we have in some particular areas. They are cleaned once a year and we have no trouble in getting the solids out by the process that we are using.

CHAIRMAN POLK: Do you have any problem in maintaining or keeping clean the connections between the sewers and the catch basins?

MR. WALLS: None at all.

CHAIRMAN POLK: Does that present a problem at all?

MR. WALLS: Not so far. It is an exception when we have to do any maintenance work of any kind on those connections. I think the answer to that is our cleaning schedule.

CHAIRMAN POLK: Are they generally on a steep enough grade to be self cleaning?

MR. WALLS: They are.

CHAIRMAN POLK: Have any of you had any trouble with that problem? I am speaking of the connections between the basins and the sewers proper.

MR. ANDERSON: If they are kept clean there is no reason for any trouble there.

MR. WALLS: I might add this to support the gentleman from Berwyn. When the interceptor sewer was built we developed a lot of trouble, as he did, in that the stuff from the mixer was just flushed into the gutter at certain locations, and of course we had to take up some of the connections between the catch basins and the sewers proper. That was due to lack of proper inspection.

CHAIRMAN POLK: How do you dispose of the material in the basins and sewers?

MR. WALLS: We take that out to our village dump. I can't see anything objectionable about it. We haven't had any complaint in that connection.

CHAIRMAN POLK: Do you handle that in that way, Mr. Anderson?

MR. ANDERSON: Yes. As soon as the water drains off it is quite inoffensive.

CHAIRMAN POLK: I think perhaps we all find it that way.

MR. WALLS: I might add that we have run into a little trouble this year. I am trying to analyze the cause of the fumes that seem to come from the catch basins. They are supposed to be sealed. Of course we went through a pretty dry period this summer. We are in a mosquito abatement district and it is the practice in that district to treat all of our catch basins and inlets. I am raising the question of whether the odor is the result of the fact that the catch basins had not been cleaned or whether it is the result of the material that is put in by the mosquito abatement district.

CHAIRMAN POLK: Do you think that gives rise to the complaint of odors?

MR. WALLS: I believe it has some bearing.

MR. WILLIAMS: I had occasion to go after our local commission on the same thing. It was brought to my attention by the fact that somebody dropped some keys into a basin. We have a separate system there. There is no sanitary sewage in our storm system whatever. On sending a man down there and stirring that thing up a very strong odor arose of what I considered sanitary sewage. I began to be worried for fear there might be a cross connection of some kind. We made a very

careful study and could find no connection for the introduction of sanitary sewage, but my sense of smell told me definitely that that was sanitary sewage. The only other thing that I could think of was this emulsion they had been spraying on the surface of the water in the catch basins. I found that they had ceased using the emulsion with a soap content about a year ago and were now using nothing but crude oil.

That doesn't solve the problem, but I still think that is what caused the odor. All I got from the official in charge was an evasion.

CHAIRMAN POLK: How do you handle complaints of sewer stoppages that come into your department, Mr. Anderson?

MR. ANDERSON: We try to handle those by avoiding them.

CHAIRMAN POLK: You anticipate the possibility and remove the cause?

MR. ANDERSON: We have had very few complaints of street sewers stopping up. Of course the house laterals stop more or less continuously because of the root formation, but we disclaim the maintenance of any house lateral from the main sewer.

CHAIRMAN POLK: Do you mean to say that you get no root trouble in the sewers themselves?

MR. ANDERSON: None at all.

CHAIRMAN POLK: It is very possible, of course, for roots to pass down the lateral and get into the main sewer.

MR. ANDERSON: We have had none of that. We clean the main sewers often enough so that there have been, I think, only two occasions in the last four years where we had any stoppage of a public sewer.

CHAIRMAN POLK: How are the sewer connections made in your town, Mr. Pav? Are they made by a plumber or does the city make them?

MR. PAV: Our city was laid out some years ago and every subdivider took care of that himself. We find that if there had been experienced men doing that work we could have avoided a lot of trouble. Our main difficulty now is from the gasoline stations. We have adopted an ordinance, such as they have in Chicago, requiring three intercepting catch basins and then the main catch basin to our main sewer. We have set a limited time during which they must put in these catch basins or else we will revoke their licenses.

CHAIRMAN POLK: Have you had any trouble in Oak Park, Mr. Walls, from garage wastes?

MR. WALLS: No, none to speak of.

With reference to your question regarding sewer stub connections, in our recent program of cleaning we ran into a lot of difficulty due to improper connections being made to the main-line sewers. The trouble was caused by poor workmanship in putting a tap into a pipe. It might stick in an inch and a half and it might stick in three inches. The result was that when we tried to get our equipment through it was impossible to get by those connections.

As a result of that we have made a ruling that whenever it is necessary to make a connection to pipes, say eight, twelve and fifteen inch sizes, that the section of pipe be taken out and a regulation connection put in.

CHAIRMAN POLK: That is very good practice.

Do you handle it that way, Mr. Williams?

MR. WILLIAMS: We follow the same method. We require the connections to be made by a plumber under our inspection. In every case of sewer connections our inspector is on the job from the time the pipe is broken until it is replaced, cemented up, and plugged or connected. We don't accept anybody's word except our own. We charge a $5 sewer connection fee which is more or less standard. That is credited to the billing department as a portion of the income for defraying the expense of the operating department.

MR. WALLS: Whose responsibility is it to make the sewer connection in to a new house? You may run into the problem where a particularly large lot is divided and there is no stub connection at the street. Whose responsibility is it to take care of that particular connection as far as the cost is concerned?

MR. WILLIAMS: The person who will be served by that connection is responsible. We base that practice on the theory that, at least in our area, the connections have been put in in years gone by under a special assessment procedure and are paid for by the property benefited. To my mind there is no reason why the people of the town at large should pay any portion of a private expense.

MR. WALLS: Is that also true with reference to maintenance?

MR. WILLIAMS: Yes, in our case. We maintain nothing beyond the main sewer lines.

MR. WALLS: Maybe we are a little bit too generous. We assume the maintenance of that particular stub from the house out to the curb line to be the property owner's responsibility, but anything under the pavement proper we assume to be our responsibility as far as main-

tenance is concerned. However, the cost of a new connection is the same as in your case.

Mr. Anderson: Who actually makes that new connection?

Mr. Walls: The plumber makes it under the inspection of the village. We also require a $50 deposit to cover the type of backfill we think necessary, which in most cases is sand or screenings. We permit no backfilling of soil that comes out unless it happens to be suitable sand. I think that is a very good practice.

Mr. Anderson: Do you let the plumber do the backfilling or do you do that yourselves?

Mr. Walls: We assume that obligation and pay for it out of the $50 deposit, returning the balance.

Mr. Anderson: That is the practice we follow also, because we found backfilling to be very hard to inspect. Unless you have men on whom you can rely pretty well you may get a poor job in spite of the fact that you stand over it the whole time.

Chairman Polk: You mean the contractor's men. We handle that in Evanston by charging a fee, as you do, to allow the department itself to put in the backfill.

Chairman Polk: Have you had any trouble from freezing of inlets or catch basins, Mr. Anderson?

Mr. Anderson: We do occasionally in very cold weather, but we have been able to control it by the use of calcium chloride. Whenever we have one that is frozen badly enough to cause flooding around an intersection we can usually clear it by the introduction of some calcium chloride. Salt will do the same thing.

Mr. Pav: We handle it in the same way. We try to keep them clean, if there should be any snow on the ground, so that we won't have that experience. Before you get over there you have a flooded area and get a thousand different complaints.

Chairman Polk: At this time of year, of course, there is clogging of these inlets due to leaves. That presents a problem to prevent street flooding.

Mr. Walls: We assume the obligation of picking up all leaves. We require generally that everybody put their refuse in proper containers, but when you get leaves coming off of property about 200 feet deep by about 100 feet wide, they will rake them off the lot and deposit them in the street. As far as the pick-up is concerned, that is the lesser of two evils, because it is easier to pick them up at that location. You can't insist that the individual put them in a container

because it would take a truck-sized container to handle them. If there happens to be a rain between times most of them are down the catch basin and the intersection is flooded. I have yet to find any means of remedying that sort of condition.

CHAIRMAN POLK: It causes a lot of complaints.

MR. WALLS: Yes. Of course the person with a small lot to maintain resents the fact that his neighbor up the street will put his leaves out in the street, and he thinks the village should do something about it. I don't know what you can do.

CHAIRMAN POLK: I understand that you don't have that trouble, Mr. Williams? How do you account for that?

MR. WILLIAMS: Our oldfashioned village streets help a great deal. We have, in the main, narrow winding streets averaging 18 feet in width, without curbs. The people living there seem to want to keep it a sort of rural appearing community. The passing of automobiles up and down the streets effectively blows away all the leaves in most cases, and the people have been pretty well trained. Most of them collect their leaves and burn them in a suitable space. Some of them do burn them on the pavement, much to our disgust, but in most cases they burn them on the driveways or in other areas provided for that purpose. We don't have a very great leaf problem, which is just our good luck, I think.

CHAIRMAN POLK: I think the absence of curbs and gutters, as you explained, is a factor.

MR. WILLIAMS: We do have some trouble on our wider, curbed streets, but not on the uncurbed streets.

CHAIRMAN POLK: I think we ought to touch on the reconstruction features of this problem. I am going to ask Mr. Anderson if he has much of that work come up in Winnetka.

MR. ANDERSON: I wouldn't say that there is a great deal, Mr. Polk. We do have, as everybody has, occasions where sewers will fail for various reasons and they just have to be dug up and replaced.

CHAIRMAN POLK: What are the commonest causes of failures where you have had to replace?

MR. ANDERSON: In our case I think the most common cause is poor subsoil. It happens that a substantial portion of our town is built in a low area, where there are quicksand pockets, peat, and poor soil in general, and the matter of support is quite important. I have had success a few times in reducing the cost of replacement of such sections by the expedient of slipping a piece of corrugated iron pipe through

the old pipe, where the size was such that it could be reduced a couple of inches without any trouble.

Chairman Polk: For how long a space?

Mr. Anderson: Well, I did it under a pavement intersection a while ago, where I put in about 35 feet of sewer, from one end.

Chairman Polk: That cuts down the capacity of the sewer very slightly.

Mr. Anderson: In that case it was 24-inch pipe and I think we cut it down to 21 inches.

Chairman Polk: Do you have any problems in that connection, Mr. Williams?

Mr. Williams: We have had some problems which arose from improper engineering and improper construction in the very early days of Glencoe. We found sewers built at improper grades, and mainly on our storm sewer system an attempt was made to construct a combination manhole and catch basin. They were placed at points required by surface drainage and not particularly well located for the purpose of cleaning or lamping through a sewer.

Then we found that if there was to be a slight curve—not a great bend but a slight curve in the sewer—they just went ahead and put in a piece of curved pipe and forgot about it. As we have a separate storm sewer system, our basins are not trapped. Those that were trapped were built so that we had to break out an area around a catch basin and reconstruct it before we could operate our sewer cleaning machine. We found other instances where the outlet of a catch basin was considerably higher than the inlet of a large sewer, which was introduced to it in its dual capacity as a manhole in that case.

We have had some very peculiar things happen. However, we are solving our problems as rapidly as we can with our own forces without attempting to reconstruct large areas of sewers.

Chairman Polk: Do you have to rebuild sewers very much in Oak Park, Mr. Walls?

Mr. Walls: To date we have had practically no rebuilding.

Chairman Polk: We have had several cases of failure in shallow sewers under a very old pavement which impact had caused to crack at the top.

We have been talking for almost an hour. I think we will throw the meeting open now to general discussion or questions.

Mr. Walls: I should like to ask a question having to do with the size of the manhole opening in relationship to the size of the pipe.

Should it not be general practice to construct manhole openings with some definite relationship to the size of the pipe that is below the ground, in order to expedite the cleaning of such pipes? In my community the manholes are standard. The biggest piece of equipment that I can get inside the pipe is regulated by the size of the manhole, which is 19 inches. Why isn't it common sense, in the case of a 5-foot pipe or a 7-foot sewer, to have an opening that would facilitate the cleaning of that particular size pipe?

MR. ANDERSON: Do you think you could handle a 7-foot bucket in a 7-foot sewer?

MR. WALLS: It is not a question of handling a 7-foot bucket.

MR. KENNETH J. KNAPP (Rochester, N. Y.): We have special manhole covers 3 feet in diameter for grate catchers. The grid is removed from those catches by a small clamp. Where we have large sewers we carry up a rectangular box to the manhole, 4½ x 3½ feet. There are two precast slabs, one of which has a small opening set in. Both of those slabs can be removed and you have your opening all the way to the main sewer.

MR. WALLS: The point I am raising is that generally throughout the metropolitan area the practice is to have one standard manhole cover.

MR. KNAPP: I think 19 inches is too small.

MR. WALLS: Ours are 22 inches. However, the maximum size you can get up and dump on the street, which is the system we are following with our present equipment, is a 19-inch bucket. In some cases if you could get a larger capacity bucket, possibly smaller in total area, you could still get the small amount that remains on the sides and clean your pipe thoroughly. We are unable to do that at the present time.

MR. PAV: I should think, Mr. Walls, that you would have less trouble with the large sewer than you would with the small one.

MR. WALLS: That all depends upon the condition of the sewer and the gradient that the sewer is on. As you know, in our particular vicinity, based on the physical characteristics of the country, the old main line sewers were laid on pretty flat gradients in order to get the proper outfall at that time. Since the Sanitary District of Chicago has put through their new interceptor, of course our interceptors are down deep enough and have the proper gradient, but that still doesn't satisfy the conditions on the old outfalls. They haven't any cleaning velocity. There are sewers up there 7 feet in diameter with 15 inches of sludge in the bottom to get out. I have got to get it out.

CHAIRMAN POLK: Does the Sanitary District handle your storm fall?

MR. WALLS: They take care of everything in the way of combination storm water flow and sanitary sewerage down through their main interceptors.

CHAIRMAN POLK: That isn't the case in the north shore communities. We dispose of that separately.

MR. JEAN L. VINCENZ (Fresno, Calif.): I think I can help Mr. Walls a little. In Los Angeles County we use what are called sewer holes. That is nothing in the world but a barricade made of boards which fits the sewer fairly well—not too well—and is put down through the manhole in sections and then bolted together. The sewage backs up behind the barricade and spills over. The spill-over causes a self-scour and the whole will go down stream with the weight of water behind it. It has a cable hooked to it and it isn't difficult to pull back up.

That is the way they clean their large sewers in Los Angeles County. As far as details are concerned, I am frank to tell you that I can't answer you.

CHAIRMAN POLK: Thank you, Mr. Vincenz. That should be of some assistance.

MR. VINCENZ: It works. It is being used still.

MR. ANDERSON: Mr. Polk, it came to my notice the other day in connection with the almost standard practice in our area of using catch basins that a good many other sections of the country do not use them at all. It seems that in many of these places the more standard practice is simply to use inlets without any sump whatever. I think some explanation might be in order of the reason we find it necessary to use catch basins in our area.

CHAIRMAN POLK: I think the tendency is to get away from the use of catch basins. We are putting in very few now.

MR. ANDERSON: Where you can get sufficient fall to keep your velocity enough to carry it away, they aren't necessary.

CHAIRMAN POLK: I do think where you have unpaved streets you have to retain the catch basins. Probably 25 per cent of our streets are still unpaved.

MR. WALLS: That is their reason in some places for adopting that style of inlet; there isn't enough debris coming off the street to justify the construction of a standard size catch basin.

MR. ANDERSON: That and the fact that they have high gradients on the sewers which run to high velocity. In this hilly country around here I can see that there would not be much chance of any deposit.

Mr. Samuel Greeley (Chicago, Ill.): Do you find it desirable to include in the Sewer Department budget an amount for reconstruction of sewers, for instance for the removal of chronic sources of trouble of which you spoke? If there is such an allocation in the budget is it a substantial part of the budget?

Chairman Polk: I can answer that for Evanston. I have found it necessary to have such a provision and we get about $4,000 a year.

Mr. Greeley: That is a very small proportion.

Chairman Polk: Yes, but it does take care of a certain amount of replacement.

How is that handled in any of the other cities?

Mr. Williams: Ordinarily we budget around $2,000 a year for replacements, which in our case is approximately 25 per cent of the total sewer maintenance budget. We find that we are able to use it and could use more every year. Most of our failures have been on deep large sewers, that is, sewers of 24 inches and up, and they have been caused by unusual circumstances. We had one case where the sewer was constructed at the bottom of a ravine, which was then filled, apparently with broken blocks of concrete pavement about 10 feet square. Those were dropped down on the sewer on top of a small amount of fill. They shattered the sewer on the upper surface and it gradually went to pieces. When it did go, the whole thing broke up. We had to replace about 300 feet of 24-inch sewer in a cut about 20 feet deep filled with broken slabs of concrete 10 and 12 feet square.

Chairman Polk: That brings up the question as to what would be a proper budget for a sewer department. The per capita expenditure in Evanston is around 30 cents. I am wondering how that compares with the general provisions for that purpose.

Mr. Anderson: Does that include catch basin cleaning?

Mr. Greeley: I recently made up a budget for a sewer rental proposition for a city of about 600,000, and my recollection is that we had for regular sewer maintenance, catch basins and the like, just about the figure you mention, 30 cents per capita. We also had included in that about 40 per cent of the total budget for reconstruction. It is a very old system and that is what prompted me to ask that question.

Mr. Anderson: I think ours would run about 50 cents per capita.

Chairman Polk: That is rather high.

Do you happen to know, Mr. Greeley, what is a normal figure for that, if you can strike an average?

Mr. Greeley: I can't remember, except that in arriving at 30 cents we did tabulate the cost from quite a number of cities where the records were well kept, for instance in Cincinnati. We were reasonably in line with the experience in these other cities.

Mr. Walls: I think in our system of sewer rental the act provides that 1/25th of the total yearly collections may be used for maintenance purposes and in addition 1/25th may be used for reconstruction purposes. The maintenance, of course, is restricted to the actual cleaning of the system and the other 1/25th is for the extension of the system where necessary.

As far as the total figures are concerned I don't recall them exactly, but they are in my mind as being about $9,000 a year, which as far as our system is concerned doesn't appear to be adequate at all.

Chairman Polk: It was brought out before, I think by Mr. Eddy, that it is advisable for all of us to attempt to obtain enough funds to carry on these activities properly. I know I have endeavored to do that. I have been able to almost double the appropriation for sewer cleaning or sewer maintenance purposes in our town and I think we are getting close to the normal amount that should be used for that purpose.

Mr. F. T. Paul (Minneapolis, Minn.): We have varied in the last ten years from 16 cents per capita to the present 18 cents, which involves the maintenance not only of our sanitary sewers and the operation of two small pumps but also the maintenance of our storm drain system, which is becoming quite large. We are attempting to separate our sewerage. We have about 25 per cent of the city separated now.

Mr. Anderson: It occurs to me, Mr. Polk, that this matter of cost per capita might vary quite a little according to the type of city.

Chairman Polk: I should think it would.

Mr. Anderson: In the more densely populated city there will be less footage of sewer per person than in the more far-flung one.

Chairman Polk: And the type of building, of course, will affect it. In your city you have homes on large areas, where there is a good deal of ground around each home.

Mr. Pav: I should like to ask if anyone has had any experience in installing a sort of basket in catch basins to catch some of the refuse that goes down there, so that you can come along periodically with your truck and not lose any time with an eductor? You just take it out and throw it in a dump truck and pass on.

Some of the councilmen thought I was spending too much money

on cleaning sewers and catch basins and wanted me to try it out. I said I would inquire of the various representatives here. Has anybody tried it?

MR. GEORGE R. THOMPSON (Detroit, Mich.): About fifteen years ago Lansing, Michigan, tried out such a bucket. I don't know whether they have continued with it or not. The high cost of the original construction, the maintenance, and the extreme difficulty of breaking the suction of that bucket seemed to mitigate against it.

CHAIRMAN POLK: The idea is good in theory but perhaps not so good in practice.

MR. EDWARD S. RANKIN (Newark, N. J.): Mr. Rosengarten, as I remember his talk yesterday, spoke of that feature and showed a view of a basin which had a bucket inside it. My objection to that is that you would have to have the diameter of your basin the same size as your opening into it, which would mean a very small catch basin. In other words, if you had your basin larger the bucket wouldn't come out through the opening.

While I am on my feet, I might tell you of the way we handle the house connection matter in my city. It is all done by a department separate from the regular maintenance department—a gang which does nothing but take care of house connections, either laying them or repairing them when necessary. We take care of them from the main sewer to the curb line, and if there is a stoppage we do the work from the curb out. We don't allow any plumbers to touch them. But from the curb in it is up to the plumbers and it is paid for by the property owner. We also charge the property owner for our work if we find it is not our fault in original construction.

MR. VINCENZ: It seems to me that the discussion of catch basins versus inlets would be better if a few more questions were asked. For four years I was in the same position as some of you, able to get around to a catch basin only once a year on the average and finding about a third of a cubic yard of material to remove. The ordinary street sweeper passing up and down a street will pick up much more than a third of a yard of material during the course of an ordinary cleaning. A rain storm will take all of that material down, and you have perhaps thirty or forty such storms during a year. The result is that you are washing into the sewer line far more material than the catch basin can hope to intercept during the course of a year.

It seems to me that all of this discussion is worrying about the tail rather than about the animal itself. If the catch basin were

eliminated completely you would not appreciably add to the cleaning load on the main line and you would avoid definitely many headaches in cleaning the catch basins themselves.

The other question which still sticks in my mind has to do with the backfilling which you have described. I have been wondering about the reasons for the introduction of new backfill in every possible installation. If that is necessary in all cases on the laterals why isn't it necessary as well on main line sewer construction? Do you bring in new backfill on your main lines?

MR. WALLS: That is the policy. For instance, in the case of any storm water sewer system that might be put in as a part of an improvement, the state requires that you use sand or screenings as backfill under the pavement that comes under their jurisdiction.

MR. VINCENZ: I can understand following the law, but I am trying to find the reason for it. Many soils are perfectly satisfactory as backfill.

MR. WALLS: I agree with you. I think as far as the stub connections are concerned it is merely a safety measure adopted by the municipalities. Unless that material is put back mechanically, that is, mechanically tamped and then paved immediately thereafter, you have not got a satisfactory backfill. However if you use sand or screenings then the backfill is going to be reasonably satisfactory. I think that is the justification for it.

CHAIRMAN POLK: I think Mr. Walls probably is referring more directly to underground work done in advance of paving which is going to follow very shortly.

MR. WALLS: It is true also of all openings made by the utilities. Unless the material coming out of the particular hole is satisfactory for backfill in our opinion, we insist that either sand or screenings be brought in. In general, in our community, it is rather a hard lumpy clay which cannot be compacted satisfactorily.

Streamlining Storm-Water Inlet Design

WALTER E. ROSENGARTEN

Lower Merion Township Engineer, Ardmore, Pa.

MUCH of the work of the engineer is awe-inspiring and may attract the attention of the general public. A great bridge may be wonderful, a dam stupendous, or a parkway beautiful. While many

other problems of the engineer are less inspiring, they are nevertheless of real importance in order that the structures may function properly. Storm-water inlets naturally fall in this latter class and too frequently their design does not receive the attention it deserves. All too often pipes and culverts valued at thousands of dollars are buried in the ground and never have an opportunity to function to capacity because of insufficient and inefficient inlet facilities. Let us therefore consider the proper design for this forgotten structure.

The function of the inlet is to receive storm water from the surface and pass it rapidly and efficiently to an underground drainage system. This is desirable (1) to prevent erosion along the road edges, (2) to reduce road maintenance expense, (3) to eliminate flooding, (4) to reduce damage to abutting property and (5) to dispose of water rapidly into its natural channels.

The proper location for inlets requires consideration. Practice has indicated that generally when sufficient water is collected on the surface to fill a 12- or 15-inch pipe, it is time to install an underground system. Along a roadway it is usually desirable to place inlets at intervals of 300 to 500 feet. This spacing is, of course, dependent on the width and grade of the road, also on the slope and the extent to which the abutting property sheds surface water toward the roadway. At corners it is better that the inlet be placed on the tangent adjoining the corner rather than in the middle of the curve.

The design of the inlet is comparatively simple but there are certain features which deserve attention. Basically it may be standardized but the location often calls for variations to suit the particular conditions. An inlet is essentially a box, which should be of sufficient size to collect the water and pass it to an outlet pipe without conflicting cross currents. It should be large enough for a man to enter or to operate pipe cleaning equipment. It should be not less than 18 inches in width by 4 feet in length. The base can best be constructed by placing a 5- or 6-inch concrete slab of 1:2½:5 mix. The surface should be flush with the flow line of the outlet pipe and slope toward it from all sides. If there is also an inlet pipe, the floor should be shaped to correspond to the lower third of the pipes to provide a smooth flow in the box. In many communities a pit is constructed to catch stones and silt. Where storm drains are laid on straight lines and grades between inlets or manholes, these basins have not been found necessary except where trapped inlets are required. They are in fact undesirable, since they interfere with free flow and serve as mosquito breeding pools.

Upon the concrete base are placed the side walls, usually 8 inches of brick. Pipes entering the inlet are built into the walls with at least 8 inches contact surface to prevent leakage and erosion. Weep holes are essential on the road side of the box at an elevation slightly below the subgrade of the road so that the water may be readily removed from the low point. If the surrounding ground is wet, small holes should be placed on all sides of the box with a blind drain of stone around the outside of the hole.

The mouth of the inlet requires special attention. In many cases this can be constructed with a row of brick placed on edge, or of concrete. The upper surface should be inclined about 1 inch in 4 inches towards the box. This will assist materially to invite the water from the road to enter the inlet. To assist still further, the speed of flow on hills should be reduced by decreasing the grade at the mouth. This can be done by streamlining or depressing the gutter for a distance of 10 or 12 feet above the inlet, this to amount to 3 to 4 inches as the inlet is approached and returning to normal curb height at the lower side of the inlet. It is not unusual on steep streets to see the water in a paved gutter pass the inlet. The designer has several conflicting requirements to meet. The gutter cannot be warped excessively to guide water into the opening or it will create a traffic hazard. A decided bump would of course be helpful in diverting the water into the inlet. The inlet mouth must not be so large as to allow a child to enter, and should usually be not over 7 inches in height. On grades of more than 5 per cent, or at sumps, grates are desirable in front of the open mouth. Various types of opening have been used in these grates, ranging from small holes to long slots. We have found it desirable to form grates by placing diagonal bars on an angle of approximately 45 degrees which will tend to divert water into the inlet.

The cover of the inlet may consist of cast iron painted with asphalt, or a stone or concrete slab with a manhole for entering the box. In the case of cast iron, a thickness of ¾ inch is sufficient if strengthened with webs, while 4 inches may be required for stone or concrete. Manhole openings vary in shape but the circular cover is to be preferred since it will not fall through its frame as will other shapes.

When an inlet connects with a drain carrying sanitary sewage, it is necessary to cut off the return of sewer gas by constructing a trap in the inlet. This can be accomplished by extending a cut-off wall down into a sump, to a level below the flow line of the outlet pipe, or by placing an inverted pipe elbow into a pit.

The outlet pipe from a box also merits consideration. If it is funneled, tests have proved that it will increase the capacity. A sharp-edged opening acts as an orifice and the necking of the stream makes it impossible to have the pipe flow to capacity. Therefore, it is desirable to make the mouth of the outlet pipe about 50 per cent larger than the diameter of the main pipe.

Since the storm-water inlet is for receiving and passing water into conduits, the flow of the water should be as smooth as possible and without interference by cross currents. It is strongly recommended that streamlining be introduced into the design. All sharp angles, corners and pockets should be eliminated. This has not been the general practice in the past but should be given serious consideration.

DISCUSSION

I. Charles Palmer

Division Engineer, Division of Sewers, Pittsburgh, Pa.

The paper ably presented by Mr. Rosengarten covers principally the design of inlets generally used in suburban and rural districts. Accordingly, I will discuss briefly some designs applicable to both unimproved and improved sections.

In order to provide a means of drainage for an unimproved street, it is very often desirable to carry the surface water to the inlet by means of a paved gutter. This gutter can be made of brick, concrete, or segments of either reinforced or terra cotta pipe. The inlet can conveniently be placed longitudinally within the gutter, with a cast-iron grating on the top conforming to the curvature of the gutter. This type of inlet can be constructed with brick or concrete and should be either square or rectangular.

When the connection is made to a combined type of sewer, the inlet should be trapped. This can be accomplished by including a chamber which has a water seal made by extending a cast-iron plate, hood, or elbow below the elevation of the outflow pipe connection to the sewer. On streets where the separate system of sewers is installed, traps or seals are unnecessary, but where the combined type of sewer exists, it is essential to use a trap properly sealed in the inlet. In many cases where the sewer is constructed on a low grade, it is also necessary to retain the grit or silt in the inlet, from which it can be removed prior to entering the sewer, to prevent its being deposited in the sewer and

The box masonry type offers advantages in that the outlet or connection to the sewer can be made from the stench chamber either directly in front of or at the sides, when the sewer is located on the roadway of the street. When the sewer is located on the sidewalk this can be done by reversing the construction of the inlet so that the connection can be made from the side nearest the sewer.

A trap for this type of inlet can be made with a cast-iron plate extending across the inlet in front of and below the outfall pipe, with the ends built in the side walls. The section between the stench plate and the outfall pipe is generally referred to as a stench chamber.

Another trap conveniently used in the box type of inlet is the cast-iron hood which also extends over and below the outfall pipe. This hood is fastened to the masonry by bolts placed in the walls to fit the holes provided in the flanges. The seal is made air-tight by means of a rubber gasket placed between the flange and the masonry. The chief advantages of this type are that only one chamber is required, and that in case the connection to the sewer becomes clogged the cast-iron hood can be removed, giving direct access for cleaning.

The old cast-iron catch basin consisting of an iron frame and bottom has largely become obsolete because of its excessive cost and the difficulty of making adjustments to changes in the alignments and grades of streets.

The cast-iron elbow extending within the inlet and below the outlet pipe is also a very economical design. Pre-cast reinforced concrete frames or reinforced pipe placed on a concrete base with an "S" trap on the side is a very good design and affords an opportunity for the use of a grit bucket for the removal of material or sediment from the inlet. This bucket is perforated and has a drop bottom for dumping. The bucket is lifted from the inlet by means of a portable hand hoist, the material is dumped into a truck, and the bucket is returned to the inlet. The time required for a complete operation, including washing, is about nineteen minutes.

Other methods of cleaning trapped inlets are by means of the hand shovel, by hand flushing, and by the eductor machine.

All types of inlets on paved streets should be designed with small openings extending through the side walls in front of the trap to the curb drains, to assure proper drainage for the road-bed and protection to the pavement. The pavement in front of and extending beyond the mouth of the inlets should be depressed or streamlined so as to provide a proper direction of flow for the water in the curb gutter.

In business sections of a city where foot traffic is heavy, inlets should be designed and placed so as to offer the least interference during wet weather. Corner inlets should be avoided. Two inlets can be used to advantage, both placed on the tangents back of the crossing area; one trapped and connected to the sewer, and the other a smaller inlet, untrapped and connected to the first. If inlets are thus placed and the paving is properly adjusted to them at the crossings, the best service will be provided.

Walter E. Kroening

Director of Service and Village Engineer, Greendale, Wis.

No matter how well a storm sewer system is designed, its function as a rapid means of carrying surface water can be hampered by inadequate facilities of introduction.

Such water-flow hindrance can be alleviated by careful consideration of inlet design. In the Milwaukee area it is the usual practice to construct inlets at intervals of about 150 to 200 feet in the commercial area, and at about 300 feet in residential districts. Generally, a 2-foot square catch basin grate cover with a curb inlet box having a 6-inch free opening is used. In recent years, the use of steel castings has been given some consideration since their greater strength permits a larger free opening area.

The inside diameter of the catch basin manhole is 3½ feet, the total depth being about 4½ feet to the floor line of the outlet sewer if a sump is used. During recent years the use of pre-cast concrete blocks for manholes has found favor, particularly since these blocks are easily made by inexperienced W.P.A. labor.

The blocks are laid on a concrete slab 9 inches thick and form a wall 6 inches in thickness. They are available in four types; the standard barrel block, the ladder block (which provides cut-outs for the insertion of manhole steps), the cone block, and the slab block. The blocks are 7¾ inches high and have an inner peripheral length of 14 inches. The outside of the concrete block manhole is given a half-inch coat of 1:2 cement mortar.

Much is to be said in favor of a streamlined no-sump inlet. However, wherever sewer grades produce velocities below 5 feet per second, it is advisable to use a catch basin with a sump, since it is cheaper to clean catch basins than sewers.

While it is true that catch basin sumps can become breeding places for mosquitoes, an occasional spraying will prevent this.

Mr. Rosengarten's recommendation that the mouth of the outlet pipe be enlarged merits the serious consideration of the designer. Not only does this provide for the full capacity use of the catch basin lead or outlet, but to a great extent it prevents sticks and other debris from clogging the entrance.

For areas having a high factor of imperviousness, such as are found in Washington, D. C., with its wide streets, drives, walks, and densely built-up sections, I believe that the type of inlet used in that city is worthy of mention. Catch basin grates are not used. Instead, curb inlets serve as overflow weirs, the length of the inlet being determined by the quantity of water to be carried. Removable concrete slabs in the sidewalk adjacent to the inlet provide means of access.

I should like to reiterate and underscore Mr. Rosengarten's recommendations pertinent to the elimination of inlet design details which cause interference. It has often been said that a chain is no stronger than its weakest link. Though a storm sewer is designed and required to transport 100 cubic feet per second, its full efficiency or dollar value cannot be appreciated if the inlet admits only 75 cubic feet per second.

Chairman Storrer: I noticed that no mention was made of how these catch basins and inlets were connected to the sewers. I presume that most of them connect directly to the manhole rather than directly to the sewer. If you have neither the sewer nor manhole to work from, there is the problem of how to relieve stoppage in the case of a trapped catch basin, unless you have a hand bowl clean-out on the other.

Mr. Kenneth J. Knapp (Rochester, N. Y.): I should like to ask the area of free water way on some of those grates.

Mr. Rosengarten: Do you mean what percentage is opening?

Mr. Knapp: In other words, is there an average area of opening on those grates and, if so, about how much does it amount to per grate?

Mr. Rosengarten: That varies in different cities considerably. You will notice that some of those grates were very small and I would imagine that in those possibly 50 per cent of the cross section was opening, whereas others were probably 4 feet. Some of them were 1 to 1½ feet wide and 6 or 8 feet long. I think it would depend upon the amount of water to be collected.

In our community we have what we call Nos. 1, 2, and 3 grates and the size used depends upon the amount of water to be picked up at the particular location.

Mr. Samuel Greeley (Chicago, Ill.): Prompted by the last question, I will tell you of an interesting incident which jolted me at the time. About 1922 I happened to be in Camagüey, Cuba, for a week. I met first the engineer, a Cuban who was a graduate of Georgia Tech and a most interesting and keen-minded fellow. The first day we drove around the city and he showed me some testing equipment he had in his yard. He was very proud of it. There was one contraption which interested me very much and I asked him what it was. It looked like a testing device for a concrete slab. It actually was about a quarter-size section of half a street, with a curb and gutter. At one end it was on jacks so that it could be tilted to different slopes. At that end there were blocks perforated at the bottom to simulate various rates of rainfall, and at the far end was a place where adjustable street inlets of different types could be placed. He was actually measuring, with different kinds of rainfall and different kinds of slope of the street, the capacity of different kinds of street inlets. I thought that was a very interesting thing to find in the center of Cuba.

Recently, and this is the reference in which you might be interested, the City and County of Los Angeles made quite an extensive series of tests of the capacity of different types of street inlets. The results of the tests have been published and can be secured from the Department of Public Works for a nominal cost, I think. I have found that a very interesting record, because it gives some specific details as to the capacity of different types and sizes of street inlets.

It would be very interesting if that could be studied further for different types of streets, particularly heavily shaded ones where the leaf problem is so important in determining the actual capacity of the street inlets as compared to the theoretical capacity when they are clean.

Mr. Walter A. Heimbuecher (University City, Mo.): The Missouri State Highway Department, for the inlets in their highways, use either a ½-inch or a ⅝-inch bar 2 inches wide, on edge, spaced 2 inches apart, held together with three rods, and varying from 3 by 5 feet to 2 by 4 feet. In some places they place the bars longitudinally, that is, with the center line of the pavement, and in others they have cross bars.

On the subject of how inlet pipes are connected to the sewer, I found

an interesting situation in one of our old sewers. The inlet had been constructed with a sump, with a trap inlet on each side of the street. It was connected to a manhole. Incidentally all our inlets are connected to manholes in the main lines. This manhole was on a 5-foot circular sewer. The top of the 12-inch pipe was level with the top of the crown of the sewer. In other words, when the sewer was running full you had a submerged outlet.

I was out there in a heavy rain and I wondered why the inlet on one side of the street was not functioning at all. The other side was taking all the water that came down its side of the street and what was running across the crown of the pavement from the one on the other side. I thought the trap was clogged, so I sent the sewer cleaning crew out there and found that it was perfectly clean. Then we came to the conclusion that the one on the downstream side was discharging against the flow of the current, which of course created a positive head on it, and the one on the upside was discharging with the stream on a 45 degree angle and was taking all the water from both of them.

That is something in inlet connection design that should be given careful consideration, especially where you are connecting the inlet to sewers of large size, so that they have free discharge above the crown of the sewer.

MR. T. R. KENDALL (New York, N. Y.): I have not heard any mention of inlets on steep grades. One of the most interesting of that type I have seen was in Tallahassee, Florida, where Miller Walston, the city engineer, uses an inlet set back under the park strip. The concrete gutter is sloped slightly more than is usual toward the curb and the gutter is continued for a distance of 6 to 8 feet back from the normal curb line. The grating or inlet is set in there with a full opening.

This arrangement is particularly beneficial in places where you have sub-tropical storms and the explosive rainfalls they get in Florida, or any place where a large quantity of water must be taken care of quickly on a heavy grade.

MR. HEIMBUECHER: I think it is in either Ottumwa or Des Moines, Iowa, where on some steep grades they put a reverse curb about 10 feet back and have the face of the inlet at right angles to the curb. They drop this off quite sharply, and then to prevent a wheel trap they simply have a 2-inch galvanized iron pipe set into the curb, so that a vehicle coming down the hill won't get into the wheel trap. It evidently does the work.

Mr. Henry L. Howe (Rochester, N. Y.): I understood one of our speakers to say definitely that where we have combined sewers we must have catch basins or trapped inlets. That may be true in his city, but I don't think it is true everywhere. I know it is not true in Rochester. We did away with the trapped inlet a good many years ago and use them only where conditions are such as to make it desirable.

Another point that might be brought up is the fact that some of the engineers on our streets now insist that the new type of sweeper used on the curbs packs the leaves against the side inlets. Incidentally, we have prongs coming up from the frame of the grating in the casting so that there is no danger of slipping your foot into them. These new sweepers, however, do pack the leaves against the side inlets, and the tendency seems to be to do away with those and use a larger, heavier grate without the side inlet.

Channelization and Safety Island Design

Carl V. Bergstrom

Director, Milwaukee County-Wide Traffic Survey

The real and significant progress in the improvement of street traffic conditions is made through the use of the "start where you are" plan. In the financial world it might be called the "cash and carry" plan.

While extensive and visionary traffic plans for the "city of tomorrow" are important for placing the goal on the horizon of the future, this year's plans for improving traffic conditions must be looked at without the enchantment of distance. The important point is that we must start today, taking our city streets and intersections as we find them, and adapt them to meet present traffic needs. In turn, the results of these improvements must be appreciated at the time of their installation and not at some future date when the final link of a series of such improvements is forged.

What we need, therefore, are methods, tools, a yardstick, and experience in dealing with these localized problems. The points of traffic inadequacy are usually found at the intersection of major thoroughfares. The engineering method of dealing with these intersectional

problems is channelization and all its ramifications. The tools are safety islands, pavement traffic markings, traffic signals and traffic signs, and roadway spot illumination. The yardstick is the accident performance before and after such improvements have been installed, and the experience has been worked up in Milwaukee and other large cities since the date of the installation of the first traffic safety island in Milwaukee in 1925.

The functional traffic of any urban area resolves itself into a pattern of necessity. This pattern, when based on field observations, creates the conventional area-wide traffic flow map with which we are all familiar. It is with this basic plan that the "start where you are" program commences. The master plan or flow map, in collaboration with accident records, rather than assumption or political pressure, should determine which intersections should be treated first. If the basic flow map calls for an adjustment through the widening of any streets, the intersections along these widened streets will, of course, take preference on the list of physical improvements.

Now let us look into the methods and tools used to improve the conditions of these intersections we have chosen. In order that we may clearly understand each other, we should at this point define a few terms.

Definition of Terms

Channelization. An over-all term given to the engineering procedure for improvement of street traffic conditions at intersections or other street locations where such improvements are based on allocating the roadway space by defining clearly the lanes or flows of traffic. These divisions of traffic are accomplished by the installation of such aids as raised traffic islands, traffic signs, and pavement markings. Channelization further implies that the over-all roadway width and curb lines be revised to meet the design and minimum space requirements for the newly established lanes of traffic.

Raised Traffic Island. A raised traffic island is that portion of the roadway or intersection pavement raised to approximately curb height for the purpose of dividing or controlling conflicting or converging streams of traffic. It also serves to form a point of vantage for pedestrians crossing the intersection or roadway. Further, it provides protection within the roadway area for persons boarding or alighting from mass carriers (streetcars or busses).

Traffic Island Marker. The means for identifying traffic islands at

night by spot illumination which comes from a light source located on and close to the surface of the island.

Traffic Island Target Sign. Any sign mounted on the island for the purpose of adding to the visible mass of the island itself or to provide a means of conveying an instruction message to approaching traffic.

Island Pedestrian Safety Factor. A term used to define that part of the island not normally occupied by pedestrians while using the island as a point of vantage. It is further that part of the island which acts as a buffer between the moving traffic and the pedestrian on the island. It is referred to in lineal feet of island.

Lateral Design. Includes all the elements or measurements of an intersection or roadway that are at approximately right angles to the direction of the flow of traffic.

Longitudinal Design. Includes all the elements or measurements of an intersection or roadway design that are in approximately the same direction as the direction of the flow of traffic.

Types of Raised Islands

Divisional and Directional Type Island. The most general and basic type of island is the one which divides traffic along the center line of the roadway or along traffic lane lines in the direction of the flow of traffic. This type usually finds its common usage as a center approach island in the roadway leading up to an intersection. Thus it physically divides traffic approaching the intersection, controls left turns, and has the pedestrian protection function at the cross-walk end of the island. In shape it is streamlined in the form of a teardrop, with the small end facing the approaching traffic and the large end terminating within the intersection cross walk. This same type of island is used anywhere along the center line of the road where a physical division of traffic is desirable, such as at the beginning of a continuous center strip, and around curved or offset portions of the roadway. The design is fundamental with a 6-inch radius forming the small end and a 3-foot radius forming the large end, connected with straight tangent sides. The length is variable to suit individual conditions and the height is standardized at 5 inches above the pavement.

The Dead Area Island. This island is usually used within the intersection of two or more streets. It covers areas within the intersection that should not be used by channelized traffic. Thus this island will take on a variety of different shapes depending upon the extension of the curb lines of the approach streets into the intersection itself. It also

has a pedestrian function in that it is usually located at mid-intersection where the pedestrian is experiencing his greatest trouble in dodging traffic. This type is usually a good location for traffic signals and street lighting facilities. It resolves wide-open intersections into a more definite character and sometimes creates several more efficient individual intersections where only one uncontrollable area existed before.

By-Pass Island. The by-pass island finds its common usage as a means of allowing right turns outside of the intersection proper. This is accomplished by the creation of a right-turn lane between the island and the intersection curb radius. An island of this type installed at an intersection reduces the area of conflicting traffic moves to a minimum and allows the installation of traffic signals on the island itself.

Mass Carrier Loading Island. This island has pedestrian usage as its major function. It allows a point of vantage within the intersection for pedestrians getting on and off streetcars and busses. It is placed in the roadway in such a position as to divide the outer or mass carrier lane of traffic from the inner or motor vehicle lane of traffic. This island should be long enough to allow the unloading of two streetcars at one time, a minimum of 70 feet for the portion of the island used by pedestrians. The design of the end of this island which faces the approaching traffic has had a great variety of interpretations in the past. It is felt, however, from Milwaukee's experience, that the type of loading island without a positive physical buffer at its front end has merit. This is proved by Milwaukee's ten-year record of no fatalities to pedestrians while on a raised loading island. The design suggested here is an adaptation of the streamline shape. At least 40 feet of island, tapered from the limit of the area used by pedestrians to the streamline end, should be allowed as a pedestrian safety factor. For additional mass visibility the island should be equipped with an identifying target sign, at least 1½ feet wide by 3½ feet high, mounted at a point on the island where the pedestrian safety factor ends and pedestrian usage commences. The night illumination of this island type, and of all the islands mentioned thus far, is very important and it is taken up in detail later in this report.

Mid-Block Types of Islands. The idea of a continuous narrow center island between intersections is coming more and more into favor. Where these strips are continuous through the length of the street, the very continuity will provide ample longitudinal visibility for the motorist. However, if short sections of center islands are used they

should be treated the same as the intersection type of center island, with the streamline end facing the approaching traffic and the length of the island being the maximum possible under the specific conditions. If an island must of necessity be short because of the interference of a filling station or a service driveway at the curb, this short island should be augmented by another island which starts ahead of the driveway in question. The final assembly then is that of one long island opened up at a point opposite the service driveway in order to allow the movement of traffic using the driveway. To the approaching motorist this dual assembly takes on the appearance of one island.

If the center islands are used for any length along a street, the opportunity should be taken to have them perform a mid-block pedestrian control function. This can be accomplished by creating on the island some kind of continuous aesthetic barrier which will exclude the possibility of pedestrian movements between mid-block curbs. Probably the best type of barrier would be a continuous hedge planted in the dirt-filled area between the curbs of the center strip.

General Specifications for Raised Traffic Islands

Design and Construction. Raised safety islands for intersection purposes are usually made of continuous concrete construction with expansion joints provided according to best practice. If the island has any appreciable size or length it may be constructed with a dirt-filled center. There are several methods of installing an island on a present roadway. If the road is asphalt, the topping is removed along the outline layout of the island and the island is poured on the concrete base. The connection between the base and the island is usually established by dowelling with steel reinforcing rods or by providing interlocking means through holes made in the sub-base with an air hammer. In the case of a concrete roadway the island is installed on top of the present roadway surface, the connection being made in the manner just described. Usually the part of the road to be contacted by the island is given a coating of bituminous material as a bond and seal against frost. When an island is constructed as part of a new roadway it is usually poured as part of the roadway base. The height of the island above the roadway surface can for practical purposes be standardized at 5 inches. No individual island of less than 5-foot width should be considered, especially if it is to afford pedestrian protection as in the case of loading islands.

In determining the length of islands the relative value of fore-

shortened longitudinal roadway objects to the driver's vision should be given careful consideration. For the purpose of discussion, it can be stated that 10 feet of actual longitudinal island length observed from a driver's point of vision 30 feet from the beginning of the island has the value of 1 lateral foot observed from this same distance. Thus an island 40 feet long would have an actual longitudinal visual value of 3½ feet to the driver's vision from 30 feet away. This leads us to the conclusion that individual islands should have a minimum longitudinal length of 40 feet, with lengths up to 80 feet well taken. Where two islands are associated together, as in the filling station driveway example, the length may be figured on the basis of the over-all length of the island assembly.

Target Signs. Target signs are the means of giving a raised traffic island added visual mass above its 5 inches of height above the pavement. For shorter islands a target sign mounted at the approach end immediately in back of the traffic marker should be sufficient. Longer islands should have signs at either end, especially if there is a need for a special traffic message at these points such as, "Keep to the right," or "No left turn." The target signs should be considered part of the island itself and no island should be allowed to go into service without this additional means of identification. The target sign is the answer to those engineers who favor a solid bulwark at the front of the island for this same identification purpose. If the visual value can be obtained without incurring the physical danger inherent in an immovable object in the roadway area, it would seem desirable. Following this same reasoning, the target signs should not be mounted so that the mounting becomes a physical hazard. An 18 x 24-inch sign mounted on a 2-inch pipe fastened to the island by any conventional means is considered a permanent installation without being a definite physical hazard in a traffic emergency.

Illumination

Many channelization and island installations are failures because of improper night identification. Such traffic islands may be effective by day but become hazards at night through the lack of illumination. However, we have for one of our basic premises the objective of keeping the island free from any involved apparatus or physical obstacles. This means, at least from the practical standpoint, that our illumination must be confined to the level of the island itself. Milwaukee has been a pioneer in what is known as spot illumination on the roadway.

The first development along this line was the mushroom light at the center of the intersection. When raised traffic islands were first built, it was a logical move to place these mushroom lights on the islands.

These marker lights, as they are now called, are installed on the island in such a manner as to indicate the physical shape of the island by the spot illumination. The marker itself should be designed to be a minimum hazard to vehicular traffic. An adaptation of the mushroom design is recommended, with lenses installed in it in focal relationship to the light source within. Amber lenses are used because this color means caution. One of the large manufacturers of floodlighting equipment produces an airport base light for runways which can be used without modification for island illumination. This assembly projects only 2 inches above the pavement level but with a special lens it affords adequate spot illumination. It is constructed so that a vehicle can drive over it without damage to either.

It is recommended that further use of the marker light source be made for floodlighting the target signs mounted on the island. This can be accomplished by using a spread light optical lens in the marker opening facing the traffic sign. The floodlighting is accomplished by making the light source within the marker adjustable so that by moving the bulb the focal beam of the light may be spotted onto any sign or object within its immediate range.

Finally, traffic islands may be illuminated by reflector buttons. Conventionally, they would be used as a warning signal, mounted to face the headlights of approaching vehicles. It is recommended instead that buttons be incorporated as part of the target signs, so that the outline and message or symbol of the sign is reflectorized. The warning signal then is the complete outline of the target sign, with the added feature of reflection of the message on the sign.

Traffic Lines. Traffic lines are the means of giving approach islands continuity with the center line of the street. The island should be bordered by a 6-inch traffic line on the pavement. This line should converge at the narrow end of the island into the center of the street traffic line, forming a smooth connection. Wherever islands are installed at intersections they should be supported by the proper crosswalk and lane lines. Cross-walk lines should not be less than 8 feet or more than 10 feet between centers. Traffic lane lines should be composed of 7-foot lines separated by 7-foot spaces.

Special Construction Features. It is not the purpose of this paper to go into construction methods in detail except in so far as they may

be novel. In this category the method of providing electrical service to the island should be mentioned. Service is obtained through either underground conduits or pipes. In either case, future electrical needs for traffic signals or street lighting standards should be anticipated. The locations for the markers on the island are usually formed out at the time the island is poured. Junctions of the underground pipes are likewise formed out in the island. Forms for the location of any future apparatus should be provided. If this is done, the concrete may be removed at any time for repairs or installations at these points without necessitating breaking up the entire island.

It was mentioned earlier that the small end of the island should have a 6-inch radius. From a concrete construction standpoint this small section is impractical. For this reason it is important that the curve portions of the island be made of armoured side wall construction of prefabricated cast iron or steel. This will allow a higher rate of island production and a more uniform product.

Intersection Design

It is impossible to go into detail as to specific channelization designs because the junctions of city streets are of innumerable types and patterns. However, we can treat one of the more common types as an example.

The off-set intersection was originally created by roads laid out along township or section lines which did not coincide at certain points. For the sake of this discussion we may assume that it is possible to acquire the necessary property to give the off-set street a new alignment. The important thing to remember in redesigning intersections is to work from the center line of the street toward the curbs. That is, the first operation should be the establishment of the new center lines of the intersections. In the case of the off-set intersection the new center line should start at a point far enough back to allow a smooth continuity of a curved center line tangent to a like arrangement in the opposite street approach.

The next step should be the establishment of the amount of lateral space to be allowed for the center island. The remaining roadway area should be allotted strictly according to traffic lanes, with a maximum of 10 feet and a minimum of 9 feet per lane. The layout at this stage will determine the new curb line and the sidewalk area. The sidewalk width may be cut down to a minimum of 8 feet. This new curb and sidewalk arrangement will determine the amount of private

property necessary to acquire. The center island design will be based on the new roadway center line and should be extended back from the intersection far enough to give smooth continuity to the new intersection alignment.

When the design has reached this stage it should be given the *driver vision test.* The layout should be viewed by looking along the edge of the drawing in approximately the same position in which the approaching motorist would see the finished installation. In almost every case the opposite roadway approach will have to be moved several feet laterally to offset the optical illusion of its not lining up.

In order to make channelization at readjusted intersections as efficient as possible, curb parking arrangements should be given careful consideration. It is entirely reasonable that parking should be eliminated for as far back from the intersection as is necessary to allow the intersection to operate at its maximum efficiency. This will enable more lanes of traffic to be operative at and near the intersection. The parking lane where used should be marked by means of pavement lines. Where traffic lanes have been established as a result of channelization they should be clearly identified by the standard arrangement of 7-foot pavement lines separated by 7-foot gaps.

Conclusion

The adjustment of city streets and intersections to present-day traffic needs is too often limited by the conflict between static property lines and the public street width. Many times the acquisition of several feet of private property for a short stretch will allow a physical traffic hazard to be permanently removed from an intersection. The question must be solved of how to handle the acquisition of this property without causing an undue financial burden. Too often a property owner will hold out for larger profits because his property is the key to the traffic solution. It is suggested here for thought that intersection improvements be put on the books as real value. In other words, if a city improves an intersection and thereby expedites traffic movement it can be assumed that real estate values at the intersection have been enhanced, especially if the improvements are backed up with better street lighting, cross-walk lines and modern traffic islands. Retail business at the intersection, including drug stores, filling stations, and restaurants, should realize additional good will as a result. Assessments made on the basis of the value of this good will in many cases can offset the cost of acquiring necessary private property.

Another type of traffic improvement requiring the acquisition of private property is the installation of a corner by-pass island at a right-angle intersection. For example, if a drug store has been built out to the property lines, to create a by-pass island at this point which would allow continuous right turns would be impossible without cutting through the corner of the drug store. The design on paper would indicate the amount of the store which would have to be sacrificed for the by-pass roadway and the new sidewalk.

It is suggested that in return for the property necessary for the improvement the municipality rebuild the store front along modern lines so that it would follow the contour of the new sidewalk line. This new store front would give increased window visibility at the small expense of floor area which was probably formerly occupied by the entrance. The second story of the building could remain as it is, supported by cantilever construction and a vertical support at the sidewalk's edge. The modernization of the intersection at this point and the resultant improvement in sales appeal should offset by far the loss of floor space or the value of the property deeded to the municipality for the purpose of the improvement.

In conclusion, it should be remembered that traffic improvements made through the installation of islands and other channelization aids should be carefully related to the master traffic plan for the city. This plan in turn is based on the area-wide traffic flow pattern and both are qualified by the constant day-to-day interpretation of the general traffic carrier needs of the city.

DISCUSSION

E. L. Knebes

City Engineer, Milwaukee, Wis.

Mr. Bergstrom has described a divisional or directional type of island shaped as a teardrop, with the large end terminating in the intersection cross walk. When the entire sidewalk area of the cross street is paved, the wide end usually terminates at about the center of the sidewalk area. If there is a tree border on the cross street and a sidewalk pavement about 5 or 6 feet wide, the island usually terminates at the projection of the center line of the sidewalk pavement. This permits pedestrians to step up on the island or to go around the end without changing their course very materially. Women with baby

carriages usually go around the island, but they still have its protection. We have taken some counts on several busy intersections, and have found that about 70 per cent of the pedestrians step up onto the island.

The dead area islands and by-pass islands must be located very carefully. It is surprising what a small change in location or shape will do. I have in mind one case known as the North Prospect Avenue and East Mason Street crossing. North Prospect Avenue was for many years the main traffic artery to the northeast section of the city. It is on the top of the bluff and adjacent to Lake Michigan. After the city had obtained the riparian rights from the property owners along the lake, a new road known as Lincoln Memorial Drive was constructed along the shore line. This new highway intersected North Prospect Avenue at East Mason Street, producing a very bad intersection for traffic. Immediately there was a demand for traffic regulators. The design of the intersection was laid out on a drafting board and then staked out in the field. The proposed islands were painted on the pavement with yellow paint and we observed how traffic reacted to the painted islands. We determined what changes were necessary to improve our original design and then constructed the islands, which have proved very satisfactory ever since. The point I want to make is that no matter how well you design on paper, the final test is on the street.

We have given a great deal of thought to mass carrier loading islands or safety zones. While these islands are only about 4 inches high, they have proved very effective. The end nearest the cross walk is always tapered to form a ramp, so as to induce the people to enter the island at the cross walk. This type of island seems to facilitate streetcar movements as well as vehicular traffic. We believe that a person standing on an island of this type has a responsibility for his safety and that the motorist must also assume some responsibility while driving past such an island.

A difficult problem with use of this type of island arises where one streetcar line continues on a tangent across the intersection and another line turns into the cross street. In such cases we have constructed as much of the raised island adjacent to the tangent track as we could and then have projected the island by painted lines up to the cross walk. This permits the car on the tangent track to load and unload at the cross walk, but the car that turns into the cross street must stop a short distance back of the cross walk. In all of our designs we have

tried to make the distance between the cross walks, and consequently between the regulators, as short as possible.

Filling station operators very seldom object to islands in the center of the street, but a streetcar loading zone must very often be shortened to satisfy them.

CHAIRMAN STORRER: I presume that some of you are thinking that channelization might work all right in larger cities, but that the small cities don't have any opportunity to use it, not having the intersections nor the traffic to warrant it.

MR. WILLIAM C. EMIGH (Coatesville, Pa.): Mr. Bergstrom's very able paper impressed me with the difference between traffic regulation in large and in small cities.

I suppose very few, if any, of you come from as small a place as Coatesville, but the traffic is often as congested in a small city as in a large city. There may be less opportunity for by-passing and rerouting traffic, and resources are usually more restricted. Then, too, there is not the opportunity for expert study. Instead of an expert and a corps of men, it is generally the man who is doing something else—perhaps handling the water supply and the sewer system and the street lighting and maintaining public relations and this, that, and the other thing—who in an odd moment or two may give a little thought to traffic.

Then again there are so many snap judgments made in small cities. For instance, a small group of taxpayers will come and say that they think there ought to be a stop sign at a particular intersection because the school children cross there. So the council says, "Yes, let's have a stop sign." As a matter of fact, there is very little traffic there, comparatively speaking, and the children are there only half an hour or three-quarters of an hour out of a total of twenty-four hours a day, on perhaps two hundred days of the year. But once the stop sign is placed, traffic must stop twenty-four hours a day all year round. It isn't logical and it doesn't make sense.

I noticed in Mr. Bergstrom's paper that he says, "While extensive and visionary traffic plans for the 'city of tomorrow' are important for placing the goal on the horizon of the future, this year's plans for improving traffic conditions must be looked at without the enchantment of distance." I fully appreciate his point, and yet it seems to me that too often in a small city we merely take the aspirin tablet to relieve the current traffic headache instead of thinking deeper and asking ourselves what the outcome is to be.

It is hard to get away, in the small city at least, from the horse-and-

buggy way of thinking. As an illustration, it is hard to persuade people that they should not be able to stop right in front of the store where they want to do some trading. I think that we must more and more get away from the idea of streets as free and public garages for storage purposes, and get back to the fundamental conception of streets as thoroughfares to move traffic. If we can accommodate people with garage space on the street in addition, well and good, but increasingly I believe that we should use parking lots.

We may follow that up by questioning what obligation government has, if any, to provide those parking lots. I think that although strictly speaking, we have no obligation in this, it is one of those things we will gradually come to, just as we provide parks and innumerable other services.

I am wondering just what the legal aspects of safety islands are with respect to accidents which may occur because of them. Our own city solicitor says that he very much questions whether a municipality in Pennsylvania could get out clear if a suit were started.

MR. DONALD M. MCNEIL (Pittsburgh, Pa.): Our largest use of the island has been in the safety zone, while Mr. Bergstrom dwelt on the center strip or dividing lines at intersections. I think that perhaps the island for safety zones, because it is constructed in the middle of two lanes of traffic in the same direction, is decidedly more of a hazard than the island either in the center or at an intersection.

We have had safety islands in Pittsburgh for about ten years. While we started out with a very simple design, we now have an abutment possibly 2½ feet high on the end of a raised concrete island. We have lately moved the floodlight back farther toward approaching cars, so that they get a direct ray of light on the slanted ends of the zone, which are cross-hatched black and white.

We had a number of lawsuits in the old days before the islands were properly illuminated. I don't know of an accident on those islands at night in the last four years, ever since we added a 200-watt floodlight. Before that time we appeared in a number of court cases, but I know of no case where the city actually paid for the damages suffered when an individual collided with that zone. I believe the city solicitor from Coatesville is mistaken when he says that the city is liable in such accidents.

MR. HENRY L. HOWE: In Rochester, New York, we are doing some channelization work, but before we went into it seriously we formed

manager, and from the engineering division of the public works department. Our representative was a young man whom we chose particularly for this work and trained by sending him to the traffic school at Yale and other colleges. So we are going at the problem with a background of experience from Milwaukee, Cleveland, and other cities that have developed this work to a high degree.

We are changing from a theory of obstruction to traffic to a theory of channelization. I have fought that theory of obstruction possibly because I am a sailor and we never put obstructions in the center of a channel. You put your signals and lights on the side of a channel and not in the center.

I want to bring out one point which I think might be helpful, supplementing what has been said about studying the layout before it actually is constructed.

In Rochester we find that in almost every case we can put a temporary layout in the street by use of painted lines and by special low standards with chains or ropes between them. We have a great many of those low standards, painted white and arranged for temporary lights, and when we go into a channelization problem we lay it out with these standards. We move them around and try numerous designs in the field before we go to the expense of constructing the permanent channels.

This practice has several important advantages, it seems to me. It educates the public, overcomes the objections of local residents, business people in particular, and avoids many costly mistakes.

Mr. Robert Mitchell (Philadelphia, Pa.): I was very much interested in Mr. Bergstrom's paper and I know from personal observation what they have done in Milwaukee.

Those of you who know Philadelphia know and appreciate that in the central business district our streets are very narrow. Most of them are 26 feet wide and most of them are one-way. At only a few points do we have an opportunity to use channelization islands. One of those is around our City Hall Plaza.

One gentleman brought up the question of the island as an obstruction. The islands around the City Hall were designed by the traffic engineer's office in 1931. However, it wasn't until 1935 that we were able to convince the city highway authorities that these islands were not going to be an obstruction but in reality would be a help to the channelization of traffic. Finally, in 1935 we did get these islands constructed and they have been a wonderful help. They have reduced our

accident rate considerably. I think since 1935 we have had only one death on these islands around City Hall, in comparison with the 8 or 10 we used to have every year. As we are handling as many as 140,000 people in 12 hours crossing these intersections, you can see that the island is a great help.

As for safety zones, we have not been able to construct any because of lack of funds. However, we have a design for one on which we are going to use a prow.

I should like to bring out one thing about the design of islands. We have taken pictures from the top of the City Hall of the movement of traffic after a snowstorm, and most of the design for our islands was based upon the pattern made by the traffic moving through the snow. I am going to give a paper in Atlantic City next week on that subject, using some slides showing the photographs. I am sorry that I don't have them here.

Pedestrian Aids

BURTON W. MARSH

American Automobile Association, Washington, D. C.

(Chairman of the Committee on Traffic Control*)

IN OUR preoccupation with the motor vehicle, we have neglected the pedestrian. And his plight is serious! Two-thirds of the persons killed in traffic crashes in cities are pedestrians. Even in non-urban areas, the ratio is from one-quarter to a third. Some 13,000 pedestrians were killed last year and about 294,000 were injured.

But neglect for the man afoot is *more frequently* brought home to the average pedestrian in other ways. Ask half a dozen pedestrians and they will tell you of unreasonable delays at stop-and-go signals, of being caught in the middle of a wide roadway with cars roaring past on both sides and with no isle of refuge.

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* COMMITTEE ON TRAFFIC CONTROL, 1940

Burton W. Marsh, Chmn. .... *Washington, D. C.*	Frank J. McDevitt ...... *St. Louis, Mo.*
George W. Barton .... *Chicago, Ill.*	Theodore M. Matson. *New Haven, Conn.*
Carl V. Bergstrom ..... *Milwaukee, Wis.*	D. Grant Mickle .... *Ann Arbor, Mich.*
L. V. Bullis .... *Washington, D. C.*	Robert A. Mitchell .... *Philadelphia, Pa.*
	A. J. Naquin .... *New Orleans, La.*

They will tell of irritation caused by drivers of turning cars who will not give them a chance to cross while their light is green. And of having to choose between a muddy shoulder or sharing a narrow hard surface with fast-moving cars—either of which is unpleasant and often unfair.

Yet this pedestrian, who represents *the most neglected major factor* in traffic, is a mighty important individual. At many a downtown intersection pedestrians outnumber vehicles ten to one. Most over-the-counter buying and paying of taxes and other bills is done by persons who have just been wearing out shoe-leather. We're all pedestrians much of the time!

Odd, isn't it, that here is one part of the traffic problem which stands out sharply upon analysis and yet which has been receiving such scant attention. It's odder yet, however, when one digs further into the facts—for they indicate very clearly some of the causes of trouble and what sort of pedestrian improvement program will be effective.

Let's look at some of the surprising "high-light" facts, based on a three-year study by the American Automobile Association. One of the most outstanding broad findings was that very few cities or states knew their pedestrian facts and fewer yet had analyzed or used the facts. Because of this situation, it is not asserted that the following key points are correct for any specific community, though for the most part they are believed to be typical.

1. *Fatalities and Injuries.* In cities, not only do pedestrians account for two-thirds of those killed in traffic crashes, but several analyses indicate that about half of those injured are persons afoot. In numerous states at least half of all persons killed on the highway are walkers.

2. *The Elderly.* Grandpa, who so frequently cautions little Johnny about crossing the street as he dashes out to go to school, little realizes that he is five times as likely to be killed as a pedestrian, as is school-aged Johnny. The curve rises sharply after age 50. (See Figure 1.)

3. *The Male.* Furthermore, it is grandpa and not grandma who is the most likely victim. A study in the nation's capital, for example, showed that 7 out of 10 of the pedestrians killed were male.

4. *Death after Dark.* But grandpa isn't being killed in the daytime. It is mainly a case of "death after dark," with several studies showing three-quarters of the pedestrian fatalities in hours of darkness. (See Figure 2.)

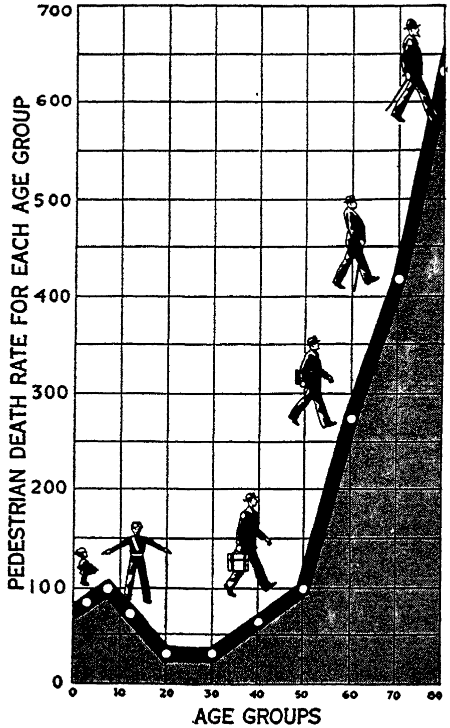

FIG. 1. That street crossings are especially hazardous for elderly pedestrians is one of the clearest facts in the pedestrian situation. Two out of three pedestrians killed are over 40. Less than one-tenth are children under 15. One-fifth are between 15 and 40. A survey in Washington, D. C., showed that persons over 50 were five times as likely as school children to be killed while pedestrians by day, six times as likely by night.

5. *Non-Drivers.* The grandpas who are being killed are mainly ones who never drove a car. Studies in Connecticut, Washington, D. C., South Carolina, Pennsylvania, and New Jersey consistently indicated that 9 out of 10, or more, of the pedestrians killed had never been licensed to drive. (See Figure 3.)

6. *Under-Privileged and Low-Income Groups.* Spotting fatalities by locations of residence of pedestrians involved in Dallas, Washington, D. C., Detroit, and other places, has indicated that certain groups have unusually high numbers of pedestrian fatalities. These are gen-

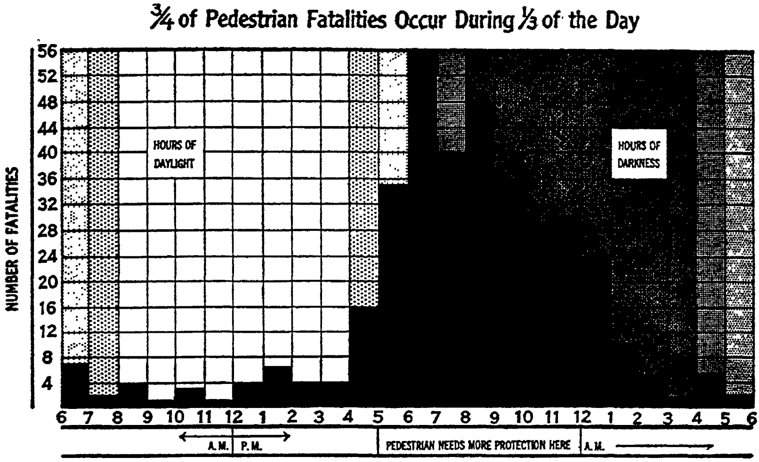

FIG. 2. The majority of pedestrians killed are meeting death after dark. Four out of five adult pedestrians killed in traffic lost their lives between 5 P.M. and 1 A.M. December, with the fewest hours of daylight, is often the deadliest month for those afoot. Data for the chart above are from the Massachusetts Registry of Motor Vehicles.

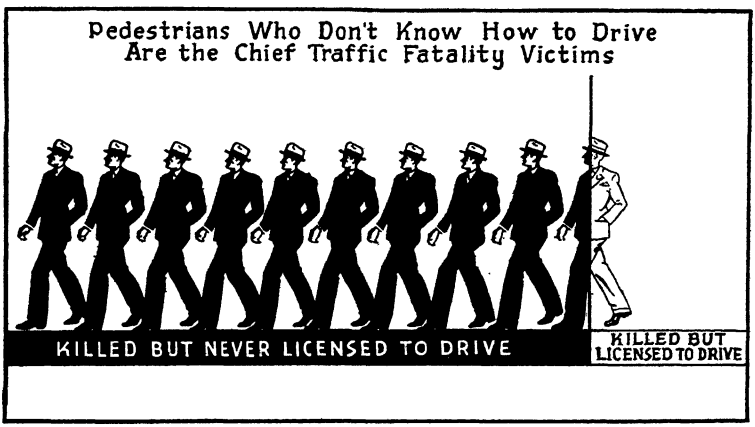

FIG. 3. Studies in Connecticut, Washington, D. C., South Carolina, Pennsylvania, and New Jersey show that unfamiliarity with problems of motor vehicle operation plays a very significant part in pedestrian fatalities. Connecticut studied 1,031 deaths to pedestrians over 15 and found that 95 per cent had never been licensed to drive. The pedestrian who has never driven is probably unfamiliar with the limitations of both motor car and driver, such as car stopping distances and the driver's inability to see pedestrians clearly at night. Education of non-driving pedestrians on such matters will pay big dividends!

erally groups like the foreign-born, non-English speaking, low-income, and those more poorly endowed mentally.

7. *Mid-block Crossings.* We hear lots of folks grumbling about difficulties they have in crossing at intersections, and you will often hear someone say "Why, it would be better to cross in the mid-block." The facts do not substantiate this statement. In Washington, D. C., for example, 3 out of 5 pedestrian fatalities occurred away from intersections. Many of these involve walking out from between parked cars—a practice against which the motorist is often almost powerless.

8. *Ingested Alcohol.* Two out of five pedestrians killed had been drinking substantial amounts of alcoholic beverages, according to studies by the Chief Medical Examiner of New York City (321 cases), and the Coroner of Cuyahoga County, Ohio (Cleveland area—193 cases).

9. *School-Aged Children.* In comparison with that of the elderly, the fatality rate for children of school age is not high. However, their injury rate in traffic is the highest of all age-groups in the data studied.

10. *Every Crash an Injury.* While roughly one out of four non-pedestrian accidents involve injury, ALMOST EVERY PEDESTRIAN CRASH INVOLVES INJURY.

11. *Wide Variance in Rates.* Pedestrian death rates and injury rates vary widely among those municipalities which know what their rates are.

It will be noted that these numbered points all relate to accidents. The studies also indicated very clearly that pedestrians encountered serious and unreasonable delays and inconveniences. However, accident records are kept and hence can be analyzed in various ways, whereas but few communities have significant data on delays or other inconveniences. Hence, while the convenience factor must be kept ever in mind, the next step is to "look behind the scenes" and seek to answer some of the questions which the above facts produce.

Reasons Behind Facts

Why do pedestrians have these troubles? What is wrong with those groups which stand out with undue prominence in the toll? To what extent and in what ways has society failed to provide proper environmental conditions? An attempt to answer such questions leads to the following statements of fact, reasoning, or belief:

1. *Unfamiliarity with Driving Problems.* Middle-aged and older

persons formed their walking habits and their attitudes before there was any considerable automobile traffic problem. They are unfamiliar with motor vehicle operation and the problems of driving. They are often unwilling to face the need for readjustments in their walking practices.

2. *Relative Invisibility of Pedestrians.* Ignorance by a great majority of pedestrians as to their relative invisibility on the highway at night is probably the greatest single cause of night-time pedestrian fatalities. The headlights look so very bright to the pedestrian that he is sure that the driver can see him long before the driver actually does. Over and over again in a special case-history study of 1,715 fatal accidents, the driver asserted that he didn't see the pedestrian or didn't see him soon enough.

A partner to this point is the failure of the average motorist to realize that the pedestrian does not have a proper understanding on this matter, and the failure of motorists to take proper corrective steps themselves (including keeping headlights in better condition, keeping windshields clean, and traveling considerably slower at night).

3. *Effects of Advancing Years.* Believed to be of considerable importance are the less keen vision and hearing, less agile pace, and lowered alertness and resistance of persons of advanced years. Momentary lapses of attention and unawareness of existing hazards are likewise important factors.

4. *Unwise Walking Practices.* Studies indicate clearly the frequency of unsound walking practices on the part of pedestrians. We greatly need general acceptance of a code for cooperative street use by motorists and pedestrians which really fits today's conditions. We must also find ways of reaching those who are often hardest to reach effectively—the underprivileged, the little educated, and those who fail to meet many of life's problems very effectively.

5. *Lack of Proper Pedestrian Facilities.* One major reason why pedestrians have trouble today is that street and traffic facilities have not been properly designed for them. For example, in Bethesda, Maryland, on the outskirts of Washington, D. C., there is a roadway in an active little business district which has a width of 90 feet from curb to curb, with no raised isle of refuge for pedestrians. It takes some elderly folks, and some mothers with baby carriages or small children, one-half minute to walk across that roadway. Even at 25 miles an hour, a vehicle goes 1,100 feet in that time. Isn't it grossly unfair

to the pedestrians not to provide pedestrian islands in such cases?

6. *Lack of Facts*. Behind it all, major reasons for existing pedestrian ills are the lack of essential local facts and lack of proper analysis and use of such data. It isn't going too far to say that most communities haven't known what certain of their pedestrian problems were and haven't done much about them.

Community Program for Pedestrian Protection

In the last two years interest in pedestrian problems has increased very greatly. It seems as though it has suddenly been realized that the pedestrian is the main sufferer and a mighty important factor in traffic. And many are now becoming interested in helping him—which leads to the question, "How should a community attack its pedestrian problems?"

Substantial and consistent improvements in pedestrian conditions can be made—records of numerous communities indicate that. But as with any other job to be done, a sound plan and program must be devised. Some of the non-glamorous but vital essentials are:

1. The chief executive of the state or city must really want results and must realize that for the major part, the job is a responsibility of government.
2. Responsibilities must be assigned.
3. Essential facts must be obtained, analyzed, and interpreted.
4. A sound and progressive program must be prepared. Necessary trained personnel and funds must be made available.
5. Coordination of the program and cooperation between those working on it, must be maintained.
6. Needs and interests of important business and civic groups must be given due attention.
7. Public support for sound official projects, and education for improvement of actions and attitudes of individuals are essential.

Local facts about pedestrian conditions and needs have been largely unknown. Why? In many communities accident report forms fail to provide important facts. In other cases reports are not thoroughly filled out. Relatively few communities are thoroughly analyzing and interpreting their accident data. Likewise, few communities make studies of pedestrian delays, or of places where pedestrian movements should be prevented because of undue interference between vehicles and walkers and because of undue hazard.

Another trouble with our present data about pedestrian accidents

is that they fail to give important information on what the pedestrian was doing before the crash, why he crossed where he did, whether or not he looked both ways, whether he had visual defects, how far away the car was when he first saw it and what he then did, whether the pedestrian in a night crash was wearing or carrying something light colored. In order to ascertain such facts, the American Automobile Association has prepared an interview form and is urging communities to make special "case history" studies among pedestrians who have been injured non-fatally.

Engineering Aids

In a well rounded pedestrian-aid program, various specialists have important parts. The importance of the engineer's part is being increasingly realized.

Engineers can greatly aid the program by insisting upon a searching, critical analysis of much that is being done affecting the pedestrian—and upon redesigns and new approaches indicated by such study. For, in many ways we are not squarely facing our pedestrian problems! And much that we are doing is seriously unfair or hazardous to pedestrians. Consider these examples, which should be under engineering control:

1. Crosswalk Design

At the usual rectangular intersection, the motorist should really need no reminder that he is supposed to yield to the pedestrian crossing legally.

However, the situation is quite different at irregularly shaped intersections and at mid-block crosswalks. At such locations, crosswalks need to be specially designed so that the motorist may be effectively forewarned that he is approaching a zone of pedestrian priority—and the design should be such that it will command motorists' attention day or night and in all kinds of weather.

Most unusually located crosswalks are deficient in a number of ways. Consider first the simple matter of paint lines. Letters must be formed to be properly legible to the approaching motorist. Because of the small angle at which the motorist views crosswalk lines as he approaches, the usual four- to six-inch line is very inadequate. Crosswalk lines 25 inches wide appear none too wide to the approaching motorist.

But that is only part of the deficiency of unusually located cross-

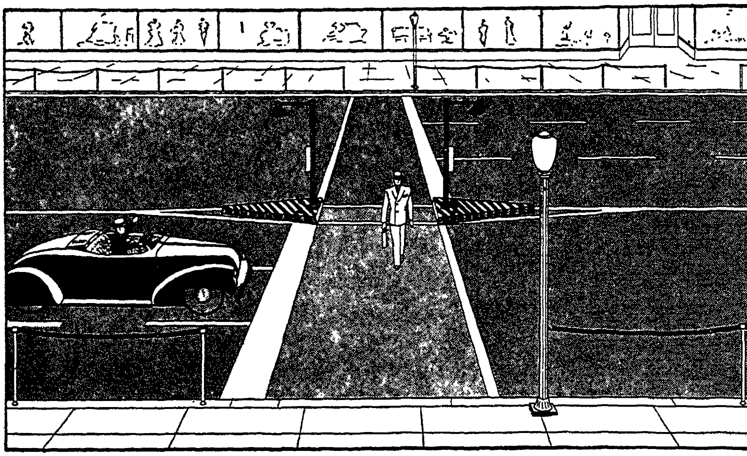

FIG. 4. It is often desirable to provide pedestrian crossing places in the mid-block or at locations other than intersections. Extreme care should be taken to make these locations quickly and clearly recognizable to drivers, both day and night. The drawing above suggests a design for a mid-block crossing with a pedestrian island. Note chain barriers along the curb, the width of the near crosswalk line, and lighting features on the island and sidewalk. The illuminated signs on the lighting posts of the islands are of standard warning shape and carry such lettering as "CROSSWALK."

walks. At night, in rain, or after snow has covered the marks, motorists unfamiliar with the location have ineffective or no advance warning. In England distinctive "Belisha beacons" help greatly to indicate 28,000 "uncontrolled" crossing places. A "before and after" study showed a 25 per cent decrease in fatalities and a 12 per cent decrease in injuries. Figure 4 shows a type of design which we believe would be even more effective for wide roadways. Americans need to wake up in design of unusually located crosswalks!

2. Barriers

At busy jogged intersections there is always some traffic flowing in the area between the jogged streets. It seems obvious that pedestrians should be prevented from crossing in that area. This can be accomplished by installation of barriers. There are also numerous other locations where barriers should be used either because of unusual hazard of walking across the street there or because of unreasonable interference of vehicular traffic occasioned by such walking. Dallas, Washington, and Rochester are among places which have installed such "pedestrian fences." The idea, which has been much more widely used in Europe, is destined for greatly increased use here. It is reported

that Milwaukee plans to install this spring on several arteries, a hedge three to four feet high in a center parkway of maximum width of five feet. One purpose will be to discourage mid-block pedestrian crossings.

3. Traffic Control Signals

While afoot, were you ever marooned out in the middle of the street at a signalized intersection with vehicular traffic roaring past uncomfortably close? You started on the proper GO signal—but the lights changed while you were en route. Remember how you felt?

This illustrates but one of a number of ways in which traffic signal installations fails to take proper account of pedestrian needs.

Clearance Interval. The trouble in the case above cited is a common one. The clearance interval following the "go" interval is usually of such length (3-5 seconds) as will permit vehicles which enter the intersection just as the light changes, to clear out of the way before cross traffic enters the intersection. Thus for a 60-foot roadway, a 3-second amber-interval will allow even a car going only 18 m.p.h. to clear (60 feet plus car length).

But what about the time required for a pedestrian to clear the same roadway? Walking speeds of course vary, but in design a somewhat slower-than-average speed should be used. At four feet per second, it would take 15 seconds to cross a 60-foot roadway. At five feet per second, the time would be 12 seconds. At the end of 3 seconds, a pedestrian would be only one-fifth to one-quarter of the way across, plus whatever distance the person had walked before the clearance light came on.

Now if we are as interested as we like to say we are in the pedestrian, his "go" interval must end 12-15 seconds before cross traffic starts, or 9-12 seconds before the amber *vehicular* clearance interval starts.

The pedestrian clearance interval can, as a matter of fact, be shortened a bit because the pedestrian starting just as the light changed would probably step back and wait, cross traffic does not cross the crosswalk at the exact instant its "go" signal shows, moving vehicles rarely crowd the far curb but are some few feet from it, etc.

How is the pedestrian to be informed as to when he should no longer start to cross? National standards call for special "walk and wait" (or "don't walk") signals. Many communities now have some "walk" signals.

But here again, pedestrian needs require study. It seems quite

unlikely that the word "walk" can be fitted into the standard signal lens by any lettering design and be legible to pedestrians of deficient vision across roadways sometimes 60 to 90 feet wide. Washington, D. C., deserves credit for experimenting with a neon tube "walk" and "don't walk" signal. From England comes word of "cross now" signals.

Too Long Intervals. Did you, while afoot, ever have to wait and wait for a red signal to change while few or no vehicles passed? If so, you will realize that such signal intervals do not encourage voluntary observance of stop-go lights by pedestrians. Many fixed-time traffic signal intervals are too long most of the day, not only for willing pedestrian observance, but also for keeping vehicular delays at a minimum. Where necessary, design should provide for changing cycle lengths, as by a time clock. For, at all times, signal intervals should be as short as will pass the closely "bunched" vehicular flow and still allow enough time for pedestrians who start at the proper time to reach a place of safety before being interfered with by cross traffic.

Location of Signal Face. As a driver, how would you feel if at a signalized intersection there were no signal to observe in the direction you were going? Yet at a great many intersections there is no signal indication in the path of travel for half of the pedestrian crossings. Is it so strange that many pedestrians fail to take advantage of the protection afforded by signal lights? In fairness there should be a signal indication directly ahead of each proper pedestrian crossing path.

Vehicle Turns. When it is decided to permit a right turn on a red light, with or without a green turn arrow, what does this mean to pedestrians? It means that a pedestrian crossing on a green light unexpectedly finds a vehicle—and often a fast-moving one—suddenly bearing down on him at a right angle. (See Figure 5). If the pedestrian doesn't know about this special movement, he is not only inconvenienced but endangered. Yet increasing numbers of such special movements are being provided "to help relieve vehicular traffic." If those responsible, and they are often engineers, gave proper consideration to the pedestrian, would they institute that plan? At the very least, there should be some special indication which would become known by walkers, which would warn them that they might encounter vehicular interference on the half of the roadway which with ordinary signal installations involves no conflicting vehicular movement.

Even at the usual type of signalized intersection, the law gives the pedestrian the right-of-way on the green light, over turning vehicles. But watch what happens and judge for yourself if the pedestrian is consistently given that preference! This is a matter for education and enforcement, but the engineer should foster attention to it.

Fairness to Pedestrians. The above examples, which are more or less typical, should suffice to indicate that many a community doesn't

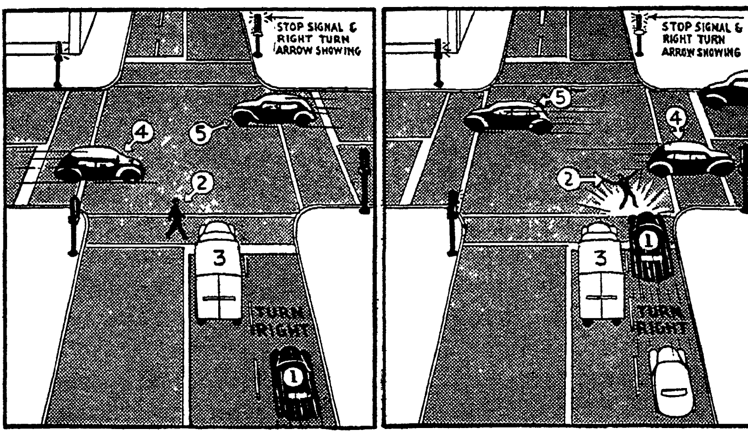

FIG. 5. Right turns on the red signal set up one more crosswalk trouble for pedestrians. In the drawing at left above, Pedestrian 2 is crossing lawfully on the "go" signal, while Car 1 is approaching for a permissible right turn, on the red. The drawing at right shows what could happen.

give the pedestrian a fair break with its traffic signals. These examples serve also to indicate the great need for much more attention to pedestrian problems and needs. The engineer is trained to face *facts* and to determine improvements in light of objective analysis and interpretation of those facts. If he will, the engineer can do much to improve conditions for those afoot.

Pedestrian Obedience to Traffic Control Signals. Should pedestrians be required by regulation to obey traffic signals? Well, that depends on whether the signals have been properly designed for pedestrian needs. If they have, and if public opinion has been developed to favor the regulation, it is generally desirable; otherwise it is not! While only a minority of pedestrian fatalities occur at signalized intersections, required obedience to signals *properly designed for pedestrians* can help greatly to impress pedestrians that they too have important responsibilities in traffic.

"Skid Pads." From St. Louis comes another valuable engineering aid to pedestrians. It consists of "skid pads" at approaches to intersections. On streets with pavement which is smooth when wet—and much sheet asphalt put down some years ago is—St. Louis is installing skid pads consisting of a cheap, durable hot bituminous mix for resurfacing right over the existing street base. Tests have shown that breaking distances from 30 miles per hour are reduced more than 50 per cent when surfaces are wet.

Good Street Lighting. Numerous cities such as Cleveland and Detroit have not only greatly improved the convenience of driving on important arteries at night, but have also greatly reduced night pedestrian accidents by well-designed, modern street-lighting.

4. Pedestrian Islands

Failure to devote proper attention to pedestrian needs extends to street and highway design. A good example is that in which the roadway of the main artery in a neighborhood business district is 90 feet wide, with no isle of refuge for pedestrians. In this particular case there was a splendid opportunity to provide an island in the middle of the roadway, for there had been streetcar tracks there, in an area not used by motor vehicles. Yet some engineer was presumably responsible for having the entire 90 feet paved, without islands.

Pedestrian islands need to be installed at a great many locations in this country. Ordinarily a pedestrian should not have to cross more than two moving lanes in each direction without an isle of refuge. On a one-way drive, three lanes in one direction should be the maximum. Milwaukee has been one of the leaders in installing proper islands, both for pedestrians and to improve the efficiency of vehicular movement.

5. Highway Sidewalks

In the field of highway design, the failure to provide warranted highway sidewalks is another example of failure to give adequate attention to pedestrian needs.

Along roads without sidewalks, especially in and near municipalities where there are numerous pedestrians or where accident analyses shows serious tolls involving pedestrians walking on the roadway, highway sidewalks should be built—and they should be so designed, surfaced and maintained that pedestrians will use them. Massachusetts has about 850 miles of them flanking state highways. Pedestrian

injuries were reduced from 513 in 1935 to 385 in 1938 where such sidewalks were built.

Yet it isn't always so easy to convince old residents of the need and value of highway sidewalks, as is indicated by the following retort to the Massachusetts traffic engineer: "Upon being told of the proposed sidewalks, one rural inhabitant proffered the information, 'I walked this rud when it was a cow-path, and so did my father and my grandfather and none of you city chaps is going to tell me what part of the rud I'll walk in.' "

Underpasses and Overpasses. Los Angeles probably leads the country in provision of underpasses with more than 100, primarily for school children. Chicago and numerous other communities also have some excellent grade separations for pedestrians. In certain places, including certain problem-locations under jurisdiction of county and state highway departments, this type of pedestrian aid is warranted, though it is generally rather expensive.

It is apparent, therefore, that there are many practical ways in which engineers can participate actively in a program for aiding the man afoot. Indeed the engineer *must* take an active part if proper progress is to be achieved. Such engineering improvements can best be provided through a traffic engineer. Every municipality of 50,000 population or more should have full-time traffic engineering. Every state should likewise have an adequate traffic engineering staff. Communities of less than 50,000 also need traffic engineering service. This may be provided through consultants or through a county traffic engineering organization in certain counties with many small municipalities. Probably the most practical permanent solution for most small municipalities is through service by an adequate state traffic engineering staff, organized with regional representatives.

Pedestrians Need Help from Many Specialists

Since this report is directed mainly to engineers, it has been appropriate to devote its major content to engineering aids. It should not be assumed, however, that a progressive pedestrian program is a job for engineers alone. To achieve maximum benefits, there must also be proper activities in the fields of legislation, enforcement, and education. Personnel training and motor vehicle administration are also important. A brief discussion of some of these activities is warranted.

Proper legislation and enforcement can be of great aid to pedestrians. In these fields, as well as in education, progressive motor

vehicle administrators are already giving highly effective leadership.

We must abandon the old belief that as pedestrians we can use streets indiscriminately. We greatly need a modern code for street use, properly set forth through legislation and generally accepted by the public. This code must present a balanced plan for priority in right of street and highway use as between motorists and pedestrians. Such a plan has been well set forth in Act V of the Uniform Vehicle Code, but the provisions have not been generally adopted and *ac-*

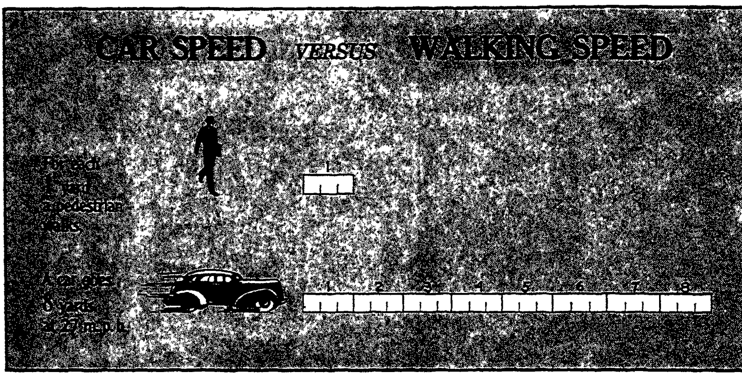

FIG. 6. The great difference illustrated above is not widely known, but it should be brought forcefully to the attention of everybody who walks. Adult pedestrians walk about five feet per second, or a little more than three miles per hour. The chart shows an eight to one advantage for cars at 27 miles per hour. At 60 miles per hour, the ratio becomes eighteen to one. To figure this ratio at any speed: divide the car's speed in miles per hour by five and multiply the result by one and one-half.

cepted. For example, while most state laws provide that the driver when turning at an intersection shall yield to any pedestrian crossing properly, this provision is very often flagrantly violated. Enforcement on this point must be stepped up greatly!

Effective enforcement programs relating to intoxicated pedestrians have been inaugurated in a few cities. In many communities, too, efficient accident investigation and intelligent selective enforcement result in very commendable emphasis on pedestrian protection. In a few places, Denver, for example, pedestrians are being penalized if their violation causes an accident.

South Carolina deserves much credit for the intelligent plan whereby highway patrol officers have been devoting one day a week to instructing pedestrians encountered on the highway.

Education holds the spotlight among today's approaches to pedestrian problems. Only a brief treatment of educational aids can be

included in this report, however. Some major considerations follow.

On what major points is there need for education? On the facts—mainly little known—on interpretation of the facts, and on what the individual should do about them. Certain basic understandings must be developed—as, for example, the tremendous difference of speed of walking and of moving cars. See Figure 6. Our phrase for what might be called average city conditions, "a car length to a step," is an effort to emphasize this point in a way which will be remembered. A statewide program in Massachusetts is also stressing such funda-

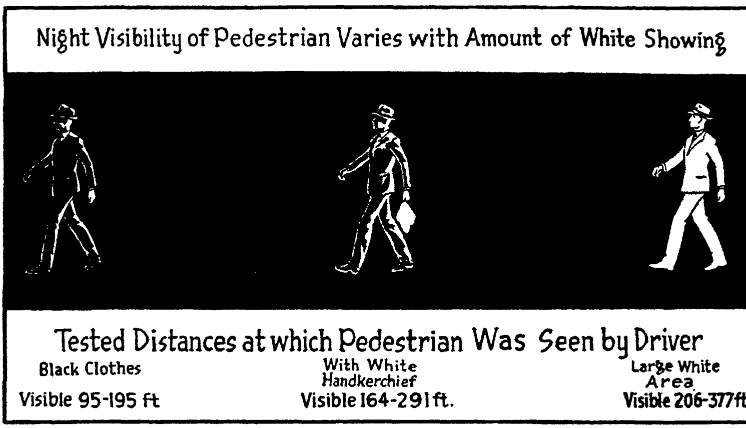

FIG. 7. Can you be seen? Whether in the city or the country, pedestrians should be warned that it is extremely difficult for drivers to see them at night. Encourage all to wear or carry something white (or very light colored) after dark. Distances shown above are from a Massachusetts study and refer to an unlighted, dark surfaced highway. In each case the shorter distance is where driver is facing glaring lights. Longer distance is when no car is approaching.

mentals through printed folders, letters to elderly residents, talks, posters, essay contests. Pedestrians must also be brought to realize how relatively invisible they are to the driver unless they carry a light, reflector or something white. See Figure 7. They must realize the distances required for the driver to react and brake a car to a stop, especially under unfavorable conditions such as slippery streets. They need to realize the many things to which a driver must give attention, so that a pedestrian will realize that a driver is not looking at him all of the time and may indeed not have seen him at all. The great importance of such education is emphasized by the fact that nine out of ten pedestrians of licensable age who are killed are non-drivers.

Many states have done much good with signs reading "Walk to Left

Facing Traffic," especially in zones near municipalities where, naturally, most non-urban pedestrian fatalities occur.

Education should be highly *selective*. It should be directed in the main toward those special groups which most need attention (such as the elderly, the non-drivers, the foreign-born, and underprivileged). It should also be directed toward the particular wrong acts and needs of each selected group. For example, school children need to have about eight sound walking rules developed into habits, while the

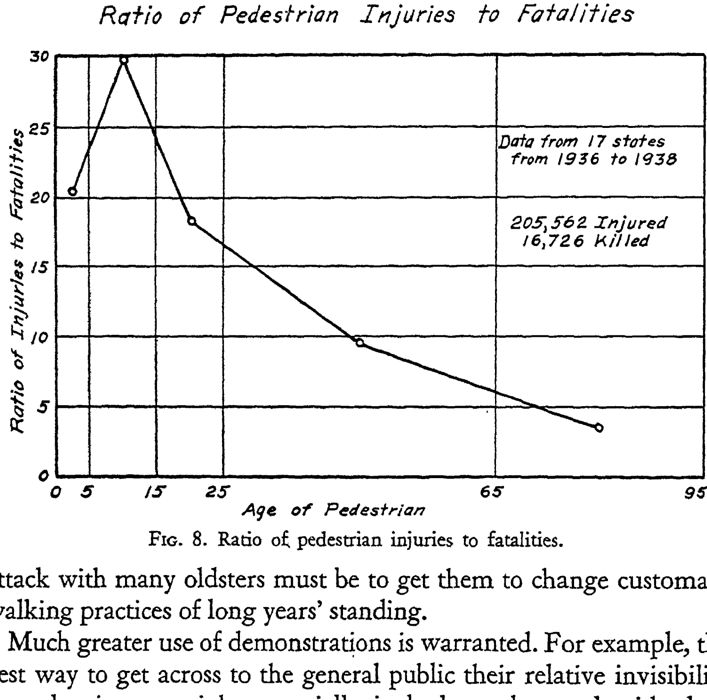

FIG. 8. Ratio of pedestrian injuries to fatalities.

attack with many oldsters must be to get them to change customary walking practices of long years' standing.

Much greater use of demonstrations is warranted. For example, the best way to get across to the general public their relative invisibility as pedestrians at night, especially in bad weather and with dark clothing, is by means of simple field demonstrations in which public interest is built up through newspaper stories, radio, etc.

Many elementary schools have long been doing a splendid safety educational job. Such work is mainly responsible for the reduction in traffic death toll to children of grade school age in the past 15 years while the trend of other age groups has been sharply upward.

However, while the fatality trend for children aged 5 to 14 has been relatively much better than that for any other age group, much remains to be done. A study by the American Automobile Association

showed that in 1937, traffic crashes were the largest single cause of death to children aged 5 to 14 (though pneumonia was practically as large). The same study showed that traffic crashes caused in that age group over one-third more deaths than diphtheria, infantile paralysis, scarlet fever, measles, and whooping cough combined!

Furthermore, another AAA study shows that children aged 5 to 14 had by far the highest ratio of traffic injuries to fatalities. (See Figure 8.) So parents and our elementary and junior high schools have a large job yet to do.

High school programs for traffic safety lag behind those in elementary schools. Yet in terms of vehicle-miles driven, youths of high school age have by far the worst fatality record of any age group. And an AAA study for 1937 indicated that traffic crashes were second only to tuberculosis as a cause of death to youths of high school age. (Data are for the group 15-19 years of age.)

The job in the lower grades of elementary school is chiefly the development of sound walking habits. For somewhat older grade school children, sound bicycling practices must be developed. In the high school, the main job is driver education and training. Fortunately active national programs are now spreading rapidly.

That school administrators see and accept their responsibilities in this field is splendidly indicated in the 1940 Yearbook of the American Association of School Administrators, which is devoted exclusively to safety education. That school authorities are tackling their parts of this problem with intelligence is also clearly indicated by several other recent publications of the National Education Association.

All sorts of educational plans for the general public are being tried. Some seem excellent, others seem ineffective and wasteful. Among the excellent programs, major mention must be made of the numerous splendid programs of newspapers and radio stations.

One of the most used educational ideas is that of signs for pedestrians. One such sign used on the Public Square in Cleveland possessed a valuable element of humor. Many a person will probably remember its message, "Jeepers Creepers, Use your Peepers," his entire life.

Conclusion

We are at last beginning to give much more thought and attention to the pedestrian. His predominant place in the traffic crash toll and in the central district traffic picture is being more generally appreciated.

Many engineers are beginning to realize that there is much that they can do to aid the man afoot. As communities begin to face their pedestrian problems squarely they become impressed with the many examples of unfairness and hazard to pedestrians which exist in their communities, and which in some instances are still being introduced.

Experience in the increasing number of communities which are attacking their pedestrian problems indicates clearly that far from being an exceedingly difficult field to tackle, there are a great many practical and effective ways of aiding the man afoot. There is every reason to believe that there will be a much brighter future for the former "forgotten man in traffic."

Low-Cost Pavements

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DURING the last ten or fifteen years a type of pavement known as low-cost or low-type pavement has been developed. I prefer to call such pavements low-cost rather than low-type because they are truly low in cost, but high in service rendered.

The advent of the automobile was responsible for the development of this type of street surface. Automobiles traveling even at the legal speed limit of 20 miles an hour on dirt and gravel residence streets raised clouds of dust that filtered into homes and covered the porches and yards. Housewives soon raised a storm of protest and the municipal government was forced to do something about the dust nuisance.

In the search for a cheap, efficient dustlayer the low-cost pavement was developed. Other attempts to eliminate nuisance led to treat-

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ment with light and heavy oils. Calcium chloride was also extensively used and is still being used; but it has to be applied each year.

Much of the credit for the development of the low-cost pavement should go to state and county highway departments, as well as to city engineers and public works officials, because they were confronted with the same dust problem.

Ten to fifteen years of successful use have proved that low-cost pavements are worth while and have a definite place in street and highway construction. Cities have spent large sums of money building high-cost, high-type pavements on streets where low-cost pavements would have given just as good results.

With the present-day development of low-cost pavements there is no reason why any city or village should have dusty residence streets. Actual experience in one Michigan city proves that a low-cost pavement will give satisfactory service for at least 14 years. This particular pavement is of the surface treatment type, built in the summer of 1927, and is still in good condition. It is 27 feet wide and is approximately half a mile in length. The subgrade is sand; concrete curb and storm sewers were in place before the pavement was constructed; and the bituminous surface treatment was applied to the so-called gravel street. Two seal coats at a cost of 6 cents a square yard have been applied since the pavement was built. The original cost was 12 cents, making a total cost to date of 24 cents a square yard, or less than 2 cents a square yard per year for construction and maintenance. I cite this case to prove that low-cost pavements are durable as well as cheap.

Although low-cost pavements are recommended for local residence streets, experience proves that they will stand up under industrial traffic when they are built on a base capable of carrying the load. Actual experience shows that a low-cost pavement is successful for streets along railroad sidings where all the freight for a city of 30,000 is unloaded. One of these pavements has carried loads of 18 tons for four years, and at this time does not show any signs of breaking up. I know of one stretch two miles long over which is hauled the majority of the sand and gravel produced by a commercial gravel pit. This pavement is a plant-mix oil aggregate type, 2 inches in thickness, laid on top of an old gravel road. It has gone through two winters carrying heavy traffic and is now in good condition. There are two or three small breakups where the subgrade was wet and springy and the gravel subgrade very thin. During the two years since its construction

this pavement has carried approximately 108,361 cubic yards of gravel in motor trucks carrying up to 10 cubic yards. Loads were not restricted during the spring breakup, the 10-cubic-yard loads being hauled during the fall, winter, and spring. It is very difficult for a person who has not seen these low-cost pavements in service to believe that they will carry the loads and give the service that they actually render.

Types of Low-Cost Bituminous Pavements

Low-cost bituminous pavements are generally divided into three classes according to method of construction.

1. Surface treatments with tars or asphalts
2. Road-mixes with tars or asphalts
3. Plant-mixes with tars or asphalts

Surface Treatments. Surface treatment consists of applying the bituminous material to the surface of the gravel street and then covering this material with crushed stone or pea gravel, providing a wearing surface approximately ½ inch in thickness.

Before the bituminous material is applied the street surface should be swept with a rotary broom to remove as much dust as possible. After the sweeping the bituminous material is applied in an amount of ¼ to ⅓ gallon per square yard. The street is then closed to traffic for 24 hours to allow the material to penetrate into the street surface as much as possible. Then a second application is made and covered with the crushed stone or pea gravel and rolled with a 5-ton roller. Excessive cover material should be removed as soon as possible as any loose material has a grinding action under traffic which is detrimental to the surface.

From my own experience I found that the surface treatment costs as much as the road-mix type. The cost of sweeping and picking up the dust from the street surface, preparatory to applying the bituminous material, was as much as the cost of mixing in the road-mix type. This would not apply on rural roads where the dust would not have to be picked up.

Road-Mix. The road-mix method provides a wearing surface of whatever thickness is wanted, usually 2 to 2½ inches. As the name implies, the bituminous material and stone or gravel are mixed on the street by means of power graders, harrows, discs, or a mixing implement developed especially for this type of work.

If the road surface is thick enough, it may be scarified to a depth

of 2 inches and this loosened material mixed with the bituminous material to provide the wearing surface. In other cases, depending on the condition of the street, an inch of stone may be added to the entire surface, or it may be necessary to add to the surface all the stone or gravel to be mixed with the bituminous material.

One advantage of this method of construction is that the street does not have to be closed to traffic for more than an hour at any time. Another advantage is that a wearing surface of any desired thickness may be had, and on city streets costs little if any more than a surface treatment.

Plant-Mix. In the plant-mix method the bituminous material and mineral aggregate are mixed in an asphalt plant and hauled to the street to be surfaced. Any desired thickness of wearing surface may be obtained and the mix can be accurately controlled, as all the materials are accurately weighed.

Several factors are bringing plant-mix into more general use. Improved plant design has reduced the cost of asphaltic concrete 75 per cent since 1920, and higher types of pavements are now entering the low-cost field.

In 1926 the writer paved an earth-fill concrete arch bridge with a 1½″—1½″ sheet asphalt pavement laid directly on the gravel fill. The surface is in excellent condition today. In 1930 a street was paved with 1½ inches of sheet asphalt on 2½ inches of black base. This pavement is also in excellent condition today. With the lowering of plant costs and the improvement in gravel or stabilized bases, high-type wearing surfaces can be laid as a low-cost pavement. That is, the whole range of bituminous pavements from a light surface to sheet asphalt may, under favorable conditions, be constructed as low-cost pavements.

Although loads carried by pavements have greatly increased in the last 20 years, the balloon tire and the almost complete disappearance of the solid rubber tire mean that the load per square inch of pavement under the largest truck load today is probably no more than that of a two-horse wagonload of coal 25 years ago.

Base Stabilization

In order to give satisfactory service a low-cost pavement must have a base capable of supporting the traffic to which it is subjected. Until recently these pavements have been constructed on gravel bases, but during the last few years great strides have been made in base stabili-

zation. Stabilizing materials now used include salt, calcium chloride, Portland cement, tar, asphaltic oil, and emulsified asphalt. The stabilization process consists of mixing 4 to 6 or more inches of the natural soil, or artificially mixed soil, sandy gravel, or other natural base material, with sufficient stabilizing material to make the aggregate firm under traffic. Low-cost pavements constructed on a stabilized base will give still longer service than those constructed on a gravel base. A low-cost pavement constructed on a gravel base 4 to 7 inches in depth will give excellent results.

With the use of stabilized bases, heavy bituminous surface treatments are adequate to carry the loads where greater wearing surface thickness was formerly required.

A soil-cement type of low-cost pavement, which is said to provide a good wearing surface, has been developed during the last few years. However, I believe it will give much better results as a base for a bituminous wearing surface than as a wearing surface itself.

Costs of low-cost pavements are unbelievably low. In cities the cost per square yard varies from 12 cents for surface treatment to 35 cents for road-mix and plant-mix.

I wish to extend my thanks to Prevost Hubbard, Hugh Skidmore, Walter N. Frickstad, A. A. Anderson, and E. L. Knebes, members of the Association's Committee on Street Paving who very kindly furnished the material from which this article was compiled.

Western Low-Type Pavements

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BEFORE discussing low-type pavements it would be well to define the term in relation to intermediate types and high types. There is no clear line of demarcation because in many cases a change of thickness will so increase or decrease the traffic carrying capacity as to shift the type from one class to another. Perhaps the best basis for distinction is found in the average number of vehicles per day carried by a two-way road. Some authorities contend that low-type surfaces

should be limited to roads that carry less than 100 vehicles a day; that an intermediate type may carry from 100 to 500 vehicles; and a high type should be used for traffic of more than 500 vehicles. Others believe that a pavement which will successfully carry as much as 300 vehicles a day and 500 or more under favorable circumstances may be designated low type; and that an intermediate type is not justified until 300 or 500 vehicles are counted. For the purpose of the following statement it is assumed that a low-type pavement is one which under average circumstances is expected to carry not more than 300 vehicles a day with a moderate amount of maintenance expense; that under some conditions of climate and soil, failures will occur or excessive amount of maintenance will be required for traffic of 100 vehicles or less; and under unusually favorable circumstances some types will carry 1,000 vehicles per day.

Selected Soil

The cheapest and most primitive type of surfacing can hardly be dignified with the title of "pavement." It is best described as "selected soil," usually obtained on the project or from some deposit convenient thereto. Depending upon the geology of the territory, it is commonly shale, calcareous material, decomposed granite, sand-clay, or sandy soil. Applied to the surface of the graded roadway, compacted and maintained by dragging and supplementary applications, such materials are not too badly affected by changes of weather and render fair service to a moderate amount of traffic. If traffic averages more than 100 vehicles a day, failures and excessive maintenance should usually be expected. Selection of material is largely based upon local experience, in recent years supplemented by screen and cementation tests on the ground or in the laboratory.

Gravel

The early method of constructing gravel surfaces accepted the natural deposit very much as it occurred. It might contain an excess or deficiency of sand and a considerable proportion of large particles, the largest of which were removed by hand after spreading on the roadway. Gravel roads are still found having particles 2 or 3 inches in diameter. Modern gravel roads have nothing over 1 inch in diameter and are reasonably well graded from that size to very fine sand and binder. Excess sand is, of course, removed.

Gravel roads are 4 to 12 inches in thickness depending upon

traffic, soil, and climatic conditions. In prolonged dry spells they are likely to disintegrate or at least become pitted. When traffic reaches 200 or 300 vehicles a day, they are apt to become corrugated, especially if the bulk of material is small in size. Under ideal conditions of climate and maintenance, gravel makes a pleasant driving surface for small volumes of traffic.

Crushed Rock

Crusher run rock is used in the same manner as gravel where it is more easily available. Earlier practice used the crusher run product with the maximum size of 2 or 3 inches. This formed a very rough riding surface, and practice about fifteen years ago in the West settled upon a maximum size of ¾ inch, producing what was known as a "fine crushed rock surface." Material was consolidated by traffic or by rolling. Many engineers insisted that binding dust should be eliminated as far as possible and relied upon the interlocking of the particles for stability. It was considered ideal to have a thin film of uncompacted rock maintained over the surface at all times. Other authorities believed in binder, often supplementing the natural product of the crusher with cementatious clay or other material if necessary. Crusher run rock surfaces, when well maintained, presented a very satisfactory driving surface except for the dust. Maintenance, however, was always difficult in dry weather.

Surface Treatment

The dust nuisance, the loss of material from the road evidenced by the dust, and the difficulty of maintaining an unbroken surface in dry weather, drew attention to the possibilities of an asphaltic surface treatment. Such treatment had proved useful on well-built macadam throughout the country and upon roads conveniently near fields which produced an oil with an asphaltic base. Generally, however, treatment of soil, gravel, and crusher run bases had not been too successfully maintained. About 1924 the State Highway Department of Oregon undertook surface treatment of gravel and crushed rock surfaces on a large scale. Using methods that had been developed earlier in California but combining therewith their established practice of systematic and constant maintenance, the program was immediately successful. The dust nuisance was eliminated and the enormous loss of material resulting from the grinding of particles under the wheels of the automobiles and its removal by wind was stopped.

The oil used in Oregon was known as "60-70 fuel oil." Such oil is now more definitely known and specified as "SC-2." The methods first used in Oregon produced a thin shell of treated material which was in effect a part of the original gravel surface. There was no distinct line of separation between the treated and untreated material. In other jurisdictions the objective has been a distinct layer of treated material, the principal aggregate being stone ⅜ to ¾ inch in diameter. Later practice in Oregon and a common practice elsewhere is to produce a combination of these distinctly separate theories. Such result would be obtained by the following process: Apply $\frac{2}{10}$ or $\frac{3}{10}$ of a gallon of SC-1 or SC-2 per square yard of carefully prepared surface; after absorption of the first application, follow with a similar amount of SC-2 or SC-3; spread and broom enough stone chips to blot the applied asphalt; roll, and remove the surplus stone chips by brooming. Sometimes a third application of asphalt is added, followed by sand or finer stone chips. The third application is common where the coarser stone chips are used or the asphalt is emulsified.

Mixing Treatment

Mixing asphalt with soil, sand, or gravel was practiced in California during the first quarter of the century with varying results. On the sandy soil of some parts of the San Joaquin Valley, roads were gradually developed by several reworkings of surface treatment until a stable impregnated mat several inches in thickness was obtained. The present practice, however, dates from extensive experiments undertaken in 1926 by the California Highway Department in the Mojave and Imperial Valleys. The roads already had 5 or 6 inches of sandy gravel. This was scarified sufficiently to produce about 3 inches of loose material. One-half gallon per square yard of 60-70 oil was applied and mixed with the loose gravel by means of a blade grader and spring-tooth harrow. The process was repeated until three applications had been placed and mixed, and the mixture was then spread and allowed to compact under drag and traffic. Present practices are essentially as developed in those experiments, excepting that valuable improvements have been made in adjusting the amount of asphaltic oil to the grading of the aggregate, selection of oil, and completeness of mixing.

The above process is commonly referred to as "mixed-in-place" or "road-mixed" surfacing and is particularly useful where the material is already on the road.

Plant Mix

A variation of the "mixed-in-place" process was quickly developed in California and is more commonly used at this time. A plant is set up at the deposit where the aggregate is found. The aggregate is carefully sampled, the amount of oil fully controlled, the mixing is thorough, and the product is hauled to the road where it is deposited in windrows and spread. Compacting is ordinarily done by rollers. All of the material is cold except the oil, which is commonly warmed. Both "road-mix" and "plant-mix" permit a wide variation in the grading of material. Ideal material follows the grading usually required of asphaltic concrete with maximum aggregate size of ¾ inch and with at least 3 or 5 per cent passing the 200-mesh sieve. Heavily sanded material containing 12 to 20 per cent of 200-mesh material has often been used. Even sandy loam is capable of fairly successful treatment. Emulsified asphalt, cut-back asphalt, and tar are used in place of asphaltic oil for surface treatment and for both types of the mixing treatment.

Surface and mixed treatments fail in the presence of capillary moisture. Untreated gravel and crushed rock seem to be often improved by the presence of capillary moisture which evaporates when it reaches the surface, but asphaltic treatment prevents evaporation and tends to the accumulation of capillary moisture under the impervious oil layer. Moisture is particularly destructive in the presence of frost.

In the western states the surface of thousands of miles of state highway and county roads carrying traffic ranging from 100 to 500 vehicles a day consists of surface or mixed treatment. Mixed treatment predominates, some of the roads carrying 1,000 vehicles a day, which is estimated to be rather more than the average economical limit.

Stabilization

During the past several years, traffic-carrying capacity for soil or inferior material has been sought through stabilization. Foundation stability for high-type pavements has also been one of the objectives of the same investigation but the possibility of converting cheap local materials into a surface capable of supporting light or moderate traffic under all weather conditions, with a small expenditure of money, has perhaps been the principal incentive. Some of the earlier experiments with asphaltic oil, such as the petrolithic process and the oil-mix soil roads of the San Joaquin Valley previously men-

tioned, may be classed as stabilization. Stabilizing materials now used include salt, calcium chloride, cement, as well as tar, asphaltic oil, and emulsified asphalt. Essentially the process involves the mixing of 4 inches, 6 inches, or more, of the natural soil, artificially mixed soil, sandy gravel, decomposed granite, calcareous soil, and similar materials, with sufficient stabilizing material to make the aggregate firm under traffic. A thin coating of aggregate and asphaltic material may or may not be added.

In the West some experimenting has been done with cement but the principal stabilization material is asphaltic oil or emulsified asphalt. Asphaltic oil, usually of the SC-2 grade, is used as described above in the road-mix treatment. The quantity of asphaltic oil is determined by various formulae, varying somewhat in the different states. The amount of 200-mesh material is the principal factor. The depth of treatment is determined by local conditions.

Stabilizing with emulsified asphalt is illustrated by the following description abstracted from a recent Oakland project:

The project ran through a soil which was in large part decomposed sand and gravel conglomerate containing 41 to 52 per cent of particles washed through a 200-mesh sieve. In the grading operation this type of soil was exposed over a large portion of the project. Other portions were covered with a substantial layer by excavating to a suitable depth and refilling with material hauled from other parts of the project. When preparing for the treatment the entire roadbed was thoroughly scarified to a depth sufficient to produce 6 inches of compacted mixed material. Large particles were broken up by the scarifying process which included adding sufficient water to thoroughly saturate the mass. Due to the large proportion of 200-mesh material passing 200-mesh, including only 1 to 3 per cent of colloidal fines, it was determined that 6 per cent of asphaltic emulsion would be necessary. Mixing was performed by a road-mixing machine which picked up the material at the front and passed it through a mixing drum and deposited it on the ground at the rear. When first mixed it had the appearance of wet clay. After drying some one to five days it was spread by blade grader, compacted with a sheeps-foot roller and finally with a rubber-tire roller or a standard roller. After drying from four days to two weeks, the stabilized material was covered with an armor coat which required 55 lbs. of coarse stone chips per square yard (1 to ⅜ inches in diameter), 25 lbs. of fine screenings (⅜ inch to 10-mesh sieve), in two applications, and 5 to 8 lbs. of sand. Four applications of emulsified road oil were used. The first was ¼ gallon per square yard applied as a tack coat prior to the spreading of coarse screenings. The second was ⅜ gallon, the third ¼ gallon applied after the spreading of the coarse screenings, and the fourth was ⅛ gallon per square yard prior to the application of sand.

On another project the aggregate for stabilization was decomposed sandstone, which carried 10 per cent of 200-mesh material. Three per cent of emulsion was found necessary. Mixing was done on the ground with blade graders. On another project the aggregate was crusher run product and the mixing was done at the plant. Sixty per cent of the material passed a 2½-inch screen and was retained on ¾-inch. Forty per cent passed the ¾-inch and included the dust which was about 10 per cent of the whole. Here again, approximately 3 per cent of emulsion was used. On one of these projects the final surface consisted of one inch of carefully graded cold asphaltic concrete, using asphaltic emulsion for binder. The cost and expected service of this pavement would perhaps place it in the intermediate type.

Low-Cost Asphalt Pavements

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HOT-MIX asphalt pavements, including sheet asphalt and dense graded aggregate asphaltic concrete, have for many years been considered the highest types of asphalt pavement. The basis of design of these pavements calls for close control of aggregate gradation, use of hot asphalt cement as a binder, adoption of a formula of proportioning to obtain maximum density in the mix after compaction, and rigid control of temperature and mixing operations. By sacrificing certain of these requirements to a limited extent and modifying methods of construction, it has been found possible to reduce first cost to produce other types of asphalt construction which may be highly satisfactory in meeting all but the most severe service condition. Such pavements have generally been termed low-cost types. They include (1) asphalt macadam, (2) road-mix and (3) cold-laid plant-mix pavements. Their relation to hot-mix pavements may best be understood by first considering the fundamental composition of the former.

In the properly prepared hot-mix pavement each particle of mineral aggregate must be uniformly coated with asphalt cement of a film

thickness sufficient to squeeze into and practically fill all void spaces between individual particles when the mass is thoroughly compacted. The compacted mass is then impervious to water and its destructive action. In order that the voids may be practically filled and that no bleeding of the asphalt to the surface shall occur, it is necessary that a considerable proportion of mineral filler be present in the mix so as to make the individual void interstices exceedingly small.

In a void-filled mixture, bleeding appears to be governed by the relation between viscosity of the binder and void diameter. Paving grades of asphalt cement have a sufficiently high viscosity under service conditions so that no bleeding occurs if voids are of the dimension produced by the presence of customary percentages of mineral filler. If, however, void diameter is materially increased, less than enough asphalt cement to fill voids must be used to prevent bleeding and the same is true if asphalt of lower viscosity, such as cut-back asphalt, is used for the same void diameter. In either case the net result is the production of a more permeable pavement than is represented by the high types.

Asphalt Macadam

The asphalt macadam constructed by the penetration method is probably the oldest and most widely known of any of the low-cost types. In this pavement void diameters are exceptionally large and, if constructed with sufficient asphalt cement to fill these voids, the pavement will bleed badly and become unstable. Cost of aggregate gradation and mixing has been eliminated at the sacrifice of density and uniform coating of aggregate particles. If, however, the surface is kept properly sealed, absorption of surface water is reduced to a minimum and, when placed on substantial, well drained foundations, this type has given excellent service. Void dimensions are so large that capillary absorption of moisture from below is practically eliminated. The asphalt macadam pavement has proved most satisfactory when constructed with a hard, durable broken stone aggregate, of suitable uniform size fragments. Uniform size is necessary to secure uniform distribution of the asphalt cement throughout the aggregate mass. Rock fragments which are soft may eventually crush under traffic to form an excessive proportion of uncoated surfaces and at the same time reduce void size to a point where capillary absorption of water may cause serious trouble.

Road-Mix Construction

Road-mix types of construction secure more thorough and uniform coating of aggregate particles than the asphalt macadam but must of necessity utilize a liquid asphalt binder of relatively low viscosity. There are two distinct types which, with certain variations, merge into each other. One is known as the macadam aggregate type and in certain characteristics resembles the asphalt macadam. That is, the aggregate particles are of uniform size and the void diameters relatively large, although not as large as in the asphalt macadam. The other is known as the graded aggregate type. When the aggregate grading is dense and contains a substantial proportion of mineral filler a close approach is made to the aggregate gradation of high-type pavements with, however, much less control of uniformity than in plant-mix work. Intermediate types contain a graded aggregate of variable composition with little or no mineral filler.

In all types the cold air-dried aggregate is first spread on the road, after which liquid asphaltic material is applied at a predetermined rate over the surface of the loose aggregate. Mixing is accomplished by grade bladers or special road-mixing machines of which there are a number of excellent designs. After the first application of asphalt has been incorporated with the aggregate, successive applications are often made and mixing continued until visual uniformity of mix is secured. Finally the mixture is spread and compacted and a seal coat applied.

In the macadam aggregate type a rapid curing cut-back asphalt is used as the binder. Much higher binding value is required than is possible to secure immediately from a product of sufficiently low viscosity to mix with the cold aggregate, and rapid curing properties are necessary to develop a strong asphalt film on the aggregate surfaces before the mixture is compacted. While greater uniformity of aggregate coating is secured, average film thickness of asphalt is less than in the properly constructed asphalt macadam and needed repairs should be promptly made to prevent rapid progressive disintegration when breaks in the surface occur.

The graded aggregate road-mix containing some proportion of natural or artificial mineral filler necessitates a certain degree of grading control, although since the mixture is made on the road the control cannot be as close as in plant-mix construction. Void diameters may be just as small as in hot-mix aggregates but cannot be filled with

asphalt as the binder must be liquid at air temperature. As the stability of the mixture is more dependent upon dense packing of the aggregate than upon strength of binder, a liquid binder can safely be used. Both medium curing cut-back asphalts, and slow-curing products commonly known as road oils, have been satisfactorily used in this type of construction. A well drained foundation which is not highly capillary in character is very important for this type as the mixture is apt to be highly capillary and, even if thoroughly sealed at the surface, may absorb an injurious amount of moisture from a wet base. Priming the surface of the base with cut-back asphalt so as to seal off the upward movement of moisture from below is particularly desirable.

In the intermediate types of road-mix which contain a graded aggregate practically free from mineral filler, capillarity is somewhat less but the compacted aggregate may be less stable and usually requires a fairly strong binder. Either rapid or medium curing cut-back asphalts are used, depending largely upon whether the aggregate more nearly approaches the macadam aggregate or the dense graded aggregate types.

Plant-Mix Construction

Low-cost cold-laid plant-mix pavements are of the same general character as all of the road-mix types. Plant mixing, however, permits the use of a more viscous binder than in road-mix construction and therefore film thickness can be made greater on macadam aggregates and the voids may be more nearly filled in graded aggregates by using a higher percentage of asphalt. Moreover, greater uniformity of mixture may be secured and proportioning more closely controlled. Either traveling or stationary mixing plants may be used. Frequently the aggregate is dried by heating prior to mixing with the asphalt binder, in which case practically the only saving in cost over high-type pavements is that incident to laying and compacting the mix when cold, or in utilizing a less expensive aggregate than might be required for hot-mix hot-lay construction. Very viscous grades of cut-back asphalts are customarily used in cold-laid mixtures or slow-curing liquid products of such high viscosity as almost to be classed as asphalt cements. Void filling is, however, not as complete as in hot-mix construction and a seal coat should be used for finishing the surface. The foundation should also be primed with asphalt.

Cold-laid plant mixes are frequently laid upon Portland cement concrete bases, usually as surfacing for old concrete pavements. Par-

ticular care should be taken to secure an intact seal, as the base is apt to act as a trap for any water that may find its way through the pervious mixture because of imperfections in the seal. Accumulations of moisture are then held by the mixture and may result in disintegration by frost action or to asphalt film stripping if the mineral aggregate is hydrophilic in character. Edgings and integral curbs should be avoided as they are apt to promote water trapping.

Soil-Cement for Light-Traffic Low-Cost Roads and Streets

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(Member of the Committee on Street Paving)

SOIL-CEMENT construction for secondary roads and streets is a new addition to the field of construction processes. It holds great promise for the light-traffic, low-cost highway programs which demand adequate and smooth-riding roads and streets for those projects on which high-type concrete pavements are not warranted because of light traffic density or small allocation of funds for construction. And yet, because it is such an innovation, the term "soil-cement" is likely to be unfamiliar to many engineers who have not had personal experience with this type of road-building material. Therefore, the purpose of this article is more to explain and clarify the definition and field of use of soil-cement than to delve into the technicalities involved in the necessary testing and construction procedures. These will be dealt with briefly, however, in order that a complete picture may be obtained of the philosophies and principles involved. Thorough laboratory investigations provide the fundamental basis of this simple process of combining the existing street or roadway material with portland cement to produce a durable, weather-resistant surface.

Many engineers have revealed that they were skeptical and held erroneous beliefs and assumptions before they were acquainted with the procedures and results to be obtained by mixing soil, cement,

and water in the proper proportions and under careful, scientific control. To the uninitiated, long familiar with the time-honored philosophy of preventing the inclusion of dirt or soil in concrete mixtures, the new idea of deliberately mixing cement with existing roadway soil appears incongruous.

However, it must be here emphasized that soil-cement mixtures for roads and streets are in no way to be confused or compared with portland cement concrete mixtures. Although containing the common ingredients of cement and water, these two materials are entirely different and each fulfills a separate and definite need for highway construction. Soil-cement construction offers a strong, durable, and weather-resistant roadway for the low-cost, light-traffic field. It is not intended for heavy-duty service where concrete is both superior and essential. In general, soil-cement construction is suitable for the improvement of secondary routes carrying up to 500 vehicles a day, including a normal proportion of heavy trucks. Average costs for this type of construction range below $5,000 per mile for a soil-cement roadway 20 feet in width and 6 inches in depth.

Experience to Date

The first roadway built following scientific laboratory and field control was near Johnsonville, South Carolina, in the late fall of 1935. In the four succeeding years, over 4,672,000 square yards of soil-cement construction have been built or placed under contract in 31 states and Alaska. Naturally, the largest field of use has been in street and highway construction, totaling 348 miles, 41 miles of which represent streets in 19 cities. Other uses to which soil-cement has been put include shoulder construction, sidewalks, parking areas, gutters, drainage ditch and swimming pool linings, levee and revetment slopes. The U. S. Army Engineers constructed 4,000 cubic yards of soil-cement gun emplacement abutments at Fort Funston, California. Twenty-nine projects involving soil-cement floors, walks, passageways, courtyards, patios, parking areas, and airport runway aprons on Treasure Island, San Francisco's Golden Gate International Exposition, aggregated 100,000 square yards, the equivalent of 23 acres.

On all these projects constructed during the past four years, scientific laboratory and field control have dictated the procedures to be followed. The tremendous background of experience has proved that this control is essential to successful construction results. And yet, although scientific and exact, the necessary laboratory test procedures

are simple. They predetermine the cement, water, and density requirements necessary for control during construction to insure reproducing the satisfactory product obtained in the laboratory. Given adequate soil type determinations, laboratory results to set up field control factors, and proper selection and use of construction equipment, engineers can predict in advance the serviceability of soil-cement construction. It is essential that control factors required for success be determined in the laboratory before field construction is undertaken. This places all work on a foundation of sound, scientific procedure, removing soil-cement construction from a hit-or-miss, trial-and-error class, and insuring accurate, predictable results.

Method of Procedure

After the street or roadway has been shaped to proper crown, grade, and alignment, a soil survey is conducted to determine all the various soil types occurring on the project and their station limits. Representative samples are obtained of each soil and taken to the laboratory for identification and complete testing to determine the cement content necessary to harden each soil satisfactorily and desirable moisture contents and densities for field control during construction. Grain size analyses and routine test constant determinations serve as a basis for identification and classification of the samples.

Following this, moisture-density relations are determined for the raw soils and for soil-cement mixtures of each soil. The data thus obtained provide information concerning desirable moisture contents and densities to be used in the field during construction and also provide data for the molding of durability test specimens.

A range of cement contents likely to harden each soil satisfactorily is selected, based on the soil classification and previously obtained data and experience. Two groups of two specimens each are molded of each soil and each cement content. One group is subjected to 12 cycles of alternate wetting and drying; the other to 12 cycles of alternate freezing and thawing. At the conclusion of each cycle of test, one specimen of each group is vigorously scrubbed with a wire scratch brush to remove loosened material, and then weighed to determine soil loss data. The other specimen of each group is not brushed, but is weighed and measured daily to supply information on volume and moisture changes during the tests. The data thus obtained from 12 cycles of durability tests allow the selection of a suitable cement content for each soil which will insure satisfactory hardness to provide

durability and freedom from detrimental volume changes under service conditions. The use of predetermined control factors and proper equipment and engineering supervision insures satisfactory construction results.

As a first step in soil-cement construction, the road or street must be shaped to proper crown and grade. Any existing material shown by laboratory tests to be unsuitable for use should be removed and replaced with acceptable material. The roadway is then scarified and pulverized for sufficient depth to produce a final compacted thickness of the recommended 6 inches. Pulverization operations are materially assisted by the use of offset disc harrows or rotary tillers.

The quantity of cement needed to produce the required spread for the cement content shown by laboratory tests to be necessary with each soil is computed from the dimensions of the area to be processed. Cement sacks are spotted at predetermined longitudinal and transverse intervals to give this spread. For mixed-in-place procedure, the sacks are dumped to form continuous windrows across the roadway. The cement is then uniformly spread by several passes of a spike tooth harrow with the spikes set flat.

Mixing of the cement is accomplished by continuous trips of disc harrows and field cultivators or rotary tillers until a uniform, homogeneous mixture is obtained. The frequent use of three- or four-bottom gang plows materially assists in turning up the bottom material that has remained unmixed, and in maintaining accurate control of depth of treatment.

Moisture content tests of the dry soil-cement mixture are made to indicate the general water requirements. Pressure distributors apply the quantity of water necessary to raise the dry soil-cement mixture to the optimum moisture content predetermined by laboratory and field tests. Frequent supplementary moisture content determinations during water application control the final addition of moisture.

Water spreading is organized to be a continuous operation with each increment partially incorporated by the use of the field cultivators or rotary tillers. The gang plows are used again to bring up to the surface the dry bottom material. Moist mixing operations are continued until the damp soil-cement mixture is uniform in character and is at the predetermined optimum moisture content plus any needed addition to compensate for losses due to evaporation during packing and finishing operations.

Sheeps-foot rollers uniformly compact the damp soil-cement mix-

ture from the bottom up to the density requirements shown by laboratory and field tests. When the rollers have packed out to within about one inch of the surface, a motor patrol gives the section final crown and grade. If necessary, additional moisture is added at this time to replace that lost by evaporation. A spike-tooth harrow then travels over the roadway to remove all top compaction planes produced by roller feet and shaping equipment. This leaves a uniform depth of mulch, which is then compacted by a smooth-wheeled tandem roller to produce a smooth, firmly bonded, and closely knit surface.

A covering, consisting of at least two inches of earth or four pounds of straw or hay per square yard, is placed over the completed work. This cover is moistened initially and kept damp for seven days, in order to protect the completed surface from evaporation, and to allow proper hydration of the cement, which is an essential factor in attaining a satisfactory product.

In addition to the mixed-in-place procedure just described, a number of projects have been constructed using large mechanical mixers. In general, these mixing machines follow one of two methods of construction. One type, designed to handle the soil-cement in place, mixes the uniformly spread cement with the previously scarified and partially pulverized soil. The other type, traveling mixing plants, work the material from a windrow to which the cement has been added. The windrow of material issuing from these machines is then uniformly spread, and compacted with sheeps-foot rollers as in the other methods. In some cases, supplementary mixing with cultivators or rotary tillers has proved beneficial as an adjunct to the machine mixing operations. On large projects, these mixing machines hold promise of proving efficient and economical. It is anticipated that the various machines now in use, or now being developed, will produce excellent results, and that the attendant costs will compare favorably with costs for mixed-in-place procedure.

Street Cleaning Expenditures in 1939

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(Chairman of the Committee on Street Cleaning*)

THE COMMITTEE on Street Cleaning has given further study during the past year to the problems of cost comparisons in this field in the hope of arriving at some basic yardstick for street cleaning expenditures by cities. It is widely recognized as difficult to make sound comparisons of costs because of the diversity of accounting practices or method of reporting charges, variations in the amount of work done, in climate and character of cities, in wage rates and leave benefits for labor, etc. Nevertheless, the Committee felt that comparisons will inevitably be made and has therefore conducted this study, with a full appreciation of the complications involved and anticipating the probable necessity of resorting to generalities.

A questionnaire was addressed to each of the thirty-seven American cities of population over 250,000 and, in addition, to four selected cities of population between 100,000 and 250,000, and to two Canadian cities. To the forty-three letters sent, there were received twenty-six replies. This questionnaire asked for information in regard to population, mileage of streets and alleys to be cleaned, area of the city, personnel during summer months, equipment regularly operated, cubic yardage of sweepings removed annually, wage rates and leave benefits, recommended frequency of cleaning of various classes of streets, budget desired, and annual expenditures. In about half of the replies received there were some points obviously open to question or a lack of information on one or more items. However, the Committee realizes the amount of effort involved in answering detailed questionnaires and wishes to express its appreciation for each reply received.

It is recognized that a large percentage of street cleaning appropriations is spent directly for labor. For this reason, wage rates can be considered of primary importance in calculating the amount of work

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* COMMITTEE ON STREET CLEANING, 1940

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which can be accomplished. An analysis of the data supplied shows first that the rate of pay per hour worked for laborers varies in the three cities in the deep South from 26 to 39 cents, with an average of 34 cents, and for truck drivers from 32 to 63 cents, with an average of 47 cents. In the other twenty-three cities, all lying above latitude 37° except one west-coast city, the rate of pay per hour worked for laborers varied from 37 to 88 cents, with an average of 62 cents, and for truck drivers from 45 cents to $1.10, with an average of 76 cents. These wage rates might be said to have a normal range (by eliminating the upper and lower quarters) from 49 to 75 cents for laborers, and from 65 to 88 cents for truck drivers. It is hardly necessary to comment that in the work of street cleaning, where the major portion of the budget is expended for laborers and drivers, such a variation in wage rates per hour worked renders useless any superficial comparison of expenditures.

This rate of pay "per hour worked" has been computed from the pay-roll amount earned per year and the number of hours actually worked during that period, after making proper deductions where necessary for vacations, sick leave, and holidays. Incidentally, the benefits varied from none to a maximum of 26 days vacation, two weeks sick leave (accumulable up to 90 days), and eight holidays. Sixteen of the twenty-three cities allowed a week or more vacation, with most of these allowing two weeks or more. Eleven of the twenty-six cities made provisions for sick leave.

Per capita expenditures as reported in these cities vary from 23 cents to $1.20, with a mean of 55 cents and a normal range, after eliminating the upper and lower quarters, of from 45 to 71 cents. A conjectural adjustment was made to these per capita costs to raise or lower the expenditures to compensate for the difference in wage rates, with results as follows:

Per capita costs under this adjustment, based upon a laborer wage of 62 cents per hour worked varied from 25 cents to $1.48, with a mean of 57 cents and a normal range, after elimination of upper and lower quarters, of from 46 to 92 cents. Very little reliable or valuable conclusions, however, can be drawn from these per capita figures. In general it is believed that the larger cities have a more complicated problem to handle and that greater unit expenditures for street cleaning purposes become necessary as the size and character of a community changes from that of a township to that of a metropolitan area.

In most cities in America that are within the snow belt, snow ex-

penditures represent rather large items, and the frequency of cleaning during the winter months is, of course, abruptly curtailed. Invariably, however, wage rates in these cities are higher than they are in the more southern latitudes where, on the other hand, street cleaning work must be carried on without curtailment throughout the winter.

Comment as to the adequacy of present appropriations was submitted by twenty of the twenty-six cities replying to the questionnaire. Of these twenty cities, eight considered their existing appropriations satisfactory, and twelve felt that an increase should be made. The average of the increase in appropriation considered necessary by the latter for more adequate street cleaning was 41 per cent of existing appropriation.

An analysis was made of the number of miles of street or alley to be cleaned per man employed for the purpose. Admittedly, the degree of mechanical cleaning by sweepers and flushers would influence the figure, apart from degree of cleanliness. However, for what it is worth, it was found that the median average was 3.35 miles of street per man employed, with a normal range, after eliminating the upper and lower quarters, of from 2.51 miles to 5.61 miles.

The annual expenditure per mile of street and alley to be cleaned showed a median average of $437, with a normal range from $337 to $670. It may be noted that the expenditures per mile of street and alley to be cleaned given here are considerably greater than those shown in *Street Cleaning Practices,* published in 1938, wherein the figures expressing this expenditure included data from many small cities and towns rather than from larger cities exclusively.

Notwithstanding the very sensible decision by the Committee authoring the manual, *Street Cleaning Practices,* to withhold a tabulation of expenditure and performance data received by it from many cities, because of fears that such data, unaccompanied by details of accounting practices, wage rates, local conditions, etc., in support or explanation, would be unfair, the writer offers below a tabulation of certain data submitted with such explanatory footnotes as space permits in the hope that it may at least serve as a starting point or springboard for discussion of cost comparisons.

Opinions submitted as to the recommended frequency of cleaning the several classes of streets are summarized as follows:

1. Business districts: Beat patrol to once daily.

2. Low class residential, thickly populated: Daily to once every two days.

Street Cleaning Data[1]

1938–1939

City	Population	Annual Expenditure for Street Cleaning Exclusive of Snow	Mileage of Streets and Alleys Cleaned	Area of City (Sq. Miles)	Personnel During Summer Months	Equipment Operated During Summer	Quantity of Sweepings Annually	Average Wage Rates Per Pay-roll Hour	Leave Allowances With Pay
New York...	7,575,339	$8,962,328	3,788	323	—[a]	Trucks[b] — Flushers 315 Mach. Sweepers 54 Misc.[c] —	1,205,075 Cu. Yds.	Laborers 69¢ Sweepers 76¢ Drivers 81¢	Vacation, 22 days; sick leave (half-pay) to 90 days or more; military duty excused with pay; at time of death in immediate family, 3 days; donors of blood to departmental employees, 3 days
Chicago.....	3,677,700	$1,694,293[d]	Streets 3,183 Alleys 1,025 4,208	213	795	—[d]	—[d]	Laborers 74¢–87¢ Drivers $1.00	Overtime pay. Per diem men 10-day vacation. Monthly (truck drivers) men receive 14 days vacation and 15 days sick leave.
Philadelphia..	2,000,000	$1,387,000	Streets 1,991 Alleys —	124	761	Trucks 4 Flushers 11 Mach. Sweepers 12 Horse-drawn Sprinklers 28 Horse-drawn Brooms 11 Horse-drawn Wagons 147	386,742 Cu. Yds.	Laborers 46¢ Drivers 60¢	Vacation, 1 week
Detroit......	1,700,000	$210,875[e]	Streets 2,000 Alleys[e]	140	250[e] (also 100 relief workers)	Trucks 25 Flushers 20 Mach. Sweepers 6 Misc. 30	94,000 Cu. Yds.	Laborers 72¢ Drivers 75¢	Vacation, 10 working days
Los Angeles..	1,400,000	$705,434	Streets 3,200 Alleys 100 3,300	451	326	Trucks 46 Flushers 12 Mach. Sweepers 15 Misc. 2	145,339 Cu. Yds.	Laborers 65¢ Drivers 75¢	Vacation, 2 weeks; lega lholidays; sick leave (part pay) to 6 weeks

Boston.......	856,000	$482,000[f]		—[g]	—	200[f] (also 300 relief workers)	Trucks Flushers Mach. Sweepers Horse-drawn sweepers Misc.	30 4 8 12 1	—	Laborers Drivers	62¢ 69¢	Vacation, 2 weeks
Baltimore....	850,000	$510,902	Streets Alleys	1,000 400 1,400	92	475	Trucks Flushers Misc. (Carts)	56 7 13	68,000 Tons	Laborers Drivers	45¢ 50¢	None
St. Louis.....	850,000	$317,591	Streets Alleys	941 428 1,369	61	247	Trucks Flushers Mach. Sweepers	40 12 5	16,588[h] Loads	Laborers Drivers	37¢ 62¢	Vacation (drivers), 20 days
San Francisco.	750,000	$545,332[j]	Streets Alleys	750 —	40	281	Trucks Flushers Mach. Sweepers Horse-drawn Flushers	23 6 4 3	73,115 Cu. Yds.	Laborers Drivers	75¢ 97¢	Vacation, 2 weeks; sick leave, 2 weeks
Pittsburgh...	669,817	$378,620[k]	Streets Streets (unpaved)	850	54 500 1,350	—[l]	Trucks[l] Flushers Mach. Sweepers Misc.	— 10 10 3	25,000 Loads (Est.)	Laborers Drivers	62¢ 75¢	Vacation, 10 days for laborers, 2 weeks for drivers
Toronto.....	650,000	$350,000	Streets	543	33	225	Trucks Flushers Wagons Misc.	11 6 17 3	140,000 Cu. Yds.	Laborers Drivers	68¢[m] 69¢	Vacation, 2 weeks (3 weeks after 10 years service); sick leave 24 days (48 days after 8 years service, 72 days after 20 years service). Statutory holidays
Washington..	635,000	$390,170	Streets Alleys	709 327 1,036	69	297	Trucks Flushers Misc.	38 12 2	148,055 Cu. Yds.	Laborers Drivers	54¢ 68¢	Annual leave, 26 days; sick leave, 15 days (cumulative up to 90 days); Legal holidays
Milwaukee...	625,000	$296,955	Streets	665	44	—[n]	Trucks Flushers Mach. Sweepers	—[n] 8 8	63,972 Cu. Yds.	Laborers Drivers	65¢ 93¢	Vacation, 10 days; sick leave, 5 days

[1] Footnotes at end of table.

Street Cleaning Data[1]—*Continued*

City	Population	Annual Expenditure for Street Cleaning Exclusive of Snow	Mileage of Streets and Alleys Cleaned	Area of City (Sq. Miles)	Personnel During Summer Months	Equipment Operated During Summer		Quantity of Sweepings Annually	Average Wage Rates Per Pay-roll Hour	Leave Allowances With Pay
New Orleans.	516,000	$280,970	Streets and alleys 343[o]	196	274	Trucks Flushers Mach. Sweepers Wagons Misc.	8 6 1 24 1	123,643 Cu. Yds.	Laborers 37¢ Drivers 46¢	None
Minneapolis..	497,000	$181,156	Streets and alleys 287 Dirt streets 613	59	94	Trucks Flushers Mach. Sweepers	25 2 7	31,521 Cu. Yds.	Laborers 83¢ Drivers 85¢ Sweeper operators 98¢	Vacation, 2 weeks; sick leave, 2 weeks; funeral of member of family, 3 days
Cincinnati...	473,421	$235,237[p]	Streets and alleys 750	72	127 (also 30 relief laborers)	Trucks Flushers Mach. Sweepers Misc.	15 5 7 2	53,919 Cu. Yds.	Laborers 56¢ Drivers 67¢–72¢	None
Newark......	452,000	$469,612	Streets 350 Alleys (Few) 350	24	186	Trucks Mach. Sweepers	8 6	89,102 Cu. Yds.	Laborers 45¢ Drivers 57¢–94¢	Vacation, 2 weeks; sick leave for Civil Service drivers only
Kansas City..	420,000	$306,814	Streets 650 Alleys 49 699	—	311	Trucks Flushers	25 3	—	Laborers 40¢ Drivers 45¢	None
Seattle.......	400,000	$247,344	Streets 817[q] Alleys 44 861	104	67	Trucks Flushers Misc.	4 7 —[r]	—	Laborers 69¢ Drivers 90¢	Vacation, 2 weeks
Rochester....	330,000	$259,000	Streets 456	—	136	Trucks Flushers Mach. Sweepers	18 8 5	—	Laborers 50¢ Drivers 65¢	—
Toledo.......	330,000	$149,623	Streets 346 Alleys 33 379	39	84	Trucks Flushers Mach. Sweepers	10 2 6	74,870 Cu. Yds.	Laborers 55¢[s] Drivers 62¢	Vacation, 2 weeks; sick leave, 2 weeks

Denver......	318,000	$383,000[t]	Streets 1,350 Alleys 237 1,587	59	221[t]	Trucks Flushers Mach. Sweepers Brooms[u] Pick-ups[u] Bob-tail trucks[u]	38[t] 5 5 6 19 18	267,000[t] Cu. Yds.	Laborers Drivers	62¢ 62¢	None
Memphis....	283,000	$65,000	Streets and alleys 810	54	82	Trucks Flushers	9 5	72,000 Cu. Yds.	Laborers Drivers	26¢ 25¢–43¢	Vacation, 7 days; sick leave, as necessary (flusher drivers only)
Syracuse.....	233,500	$76,452[v]	Streets and alleys 237	25	74	Trucks Flushers Mach. Sweepers	11 5 6	36,360 Cu. Yds.	Laborers Drivers	45¢ 53¢	None
Jacksonville..	190,000	$89,435	Streets 622 Alleys 70 692	39	43	Trucks Mach. Sweepers	9 3	51,669 Cu. Yds.	Laborers Drivers	39¢ 63¢	—
Berkeley.....	100,000	$25,000	Streets 198 Alleys (Few) 198	9	29	Trucks	3	—	Laborers Drivers	55¢[w] 67¢	Vacation, 1 week; sick leave, 10 days to 90 days, depending on service

[a] Average daily total of 9,680 employees engaged by Department of Sanitation, New York.
[b] A total of 1,280 collection trucks operated by the Department of Sanitation, New York.
[c] A total of 321 pieces of miscellaneous equipment operated by the Department of Sanitation, New York.
[d] Street sweepings hauled with ash truck equipment, generally mixed with ash collection. No separate record of yardage is kept. Street repair trucks assist in cleaning work. "No mechanical equipment" (for cleaning).
[e] No separate budget item for street cleaning which is combined with alley cleaning. Alleys cleaned by rubbish collection crews. Received assistance of approximately 100 relief laborers per day. Truck maintenance costs or other charges not included in expenditure given.
[f] Received assistance of 300 relief men.
[g] Data supplied for total mileage covered in year, 56,206 miles.
[h] Loads shown are for 1½-ton trucks.
[i] Computed from given rate of $130 per month.
[j] Truck maintenance not included.
[k] Truck maintenance costs not included, charged to Division of Garage and Repair Shop.
[l] Bureau of Highways and Sewers is responsible for street and sewer cleaning and street and sewer repair and maintenance. Hence, it is impossible to separate the labor or labor time dedicated to street and sewer cleaning as distinguished from street and sewer maintenance.
[m] Computed from given rate of $30.00 and $30.60 per week, respectively.
[n] Data supplied for entire Bureau of Street Sanitation, including refuse collectors.
[o] Also, 1,275 miles of unpaved streets.
[p] Exclusive of leaf removal (7,431 cu. yd. @ $1.219 av.) and relief labor.
[q] Also, 221 miles of permanently graveled streets.
[r] Also, 3 Eductors for catch basin cleaning.
[s] Computed from given rates of $114.50 and $130.00 per month, respectively.
[t] Data includes collection of rubbish (other than ashes and building materials) from households once every 5 weeks. Tree and shrub population of 3,500,000 and collection of leaves from private property accounts for large part of yardage collected.
[u] The bob-tail trucks (short-wheel-base trucks) are used to pull the 6 brooms (curb sweepers) and the 19 pick-ups which are used to take up the windrows after brooming. Also, the bob-tail trucks pull rack-wagons used to collect leaves and light household rubbish other than ashes. Paved alleys are brushed twice a year.
[v] Maintenance of equipment not included.
[w] Computed from given wage rate schedule.

3. High class residential, thickly populated: Two to three times a week.

4. Outlying residential or suburban streets: Once a week.

It is to be commented that the recommended frequency of cleaning reported in some instances varied materially from the average frequencies given above.

The quantity of sweepings removed annually from the streets per 1,000 of population was found to have a median average of 160 cubic yards, with a normal range, after eliminating the upper and lower quarters, of 103 to 229 cubic yards per 1,000 population.

The quantity of sweepings removed annually from the streets per mile of street and alley to be cleaned was found to have a median average of 96 cubic yards, with a normal range, after eliminating the upper and lower quarters, of from 46 to 194 cubic yards per mile.

It was hoped that an analysis of the compiled data, with adjustments to compensate for difference in wage rates, population, area, etc., would furnish some reasonably accurate conclusions with respect to the relative cost of street cleaning work in large cities, and that perhaps basic minimum unit costs might be established. In order to accomplish such a task it is obviously necessary that detailed and exhaustive studies be made of each city concerned. Valid nation-wide comparisons would depend upon the correlation of the cost data on a substantial and uniform basis, and some general evaluation by personal inspection of the standards of cleanliness. Until someone undertakes this project, or finances the cost of such a survey, it is concluded that very little can be done with this proposition.

With few exceptions there seems to be insufficient money available in most of the larger cities to enable the maintenance of proper standards of cleanliness. Any improvement in general conditions now existing will only come after a change in the attitude of the public with respect to the inviolability of public space and this necessary and vital psychological reaction cannot come without strict enforcement of anti-litter ordinances. Also, while it is conceivable that civic pride will cause private citizens to refrain from littering a clean street, there is nothing in a partially cleaned or dirty street to appeal to this pride. Therefore, the primary requisite of any real progress in this direction is adequate cleaning by the municipality, supplemented and accompanied by a steady and long-range program of enforcement of the law. The utimate result would be cheaper street cleaning costs and scrupulously clean public space at all times.

The Sanitary Fill Method of Refuse Disposal

JEAN L. VINCENZ
Commissioner of Public Works, Fresno, Calif.

IN DISCUSSING the sanitary fill method of refuse disposal, let me make it very plain that we are emphasizing the word *sanitary* in this particular discussion. Recently I read an indictment of the sanitary fill method in which the story was told of a youngster's selling meat he had obtained from the dump. Evidently the gentleman writing the article was unable to distinguish between a garbage dump and a sanitary fill method of disposal.

Because I believe so strongly in the importance of proper public relations, I am going to digress for a moment to mention some of the problems that confronted our city in initiating the sanitary fill method. Frankly, I believe the political and public relations aspect of garbage disposal is fully as important as the technical side. You probably all agree with me on that. The details of the studies made, the furor raised when the recommendation was made that the city operate its own waste disposal department, and the ensuing battle during which four of us city commissioners were sued by the fifth to prevent the municipal operation, make an interesting story, but we have no time to recount it here.

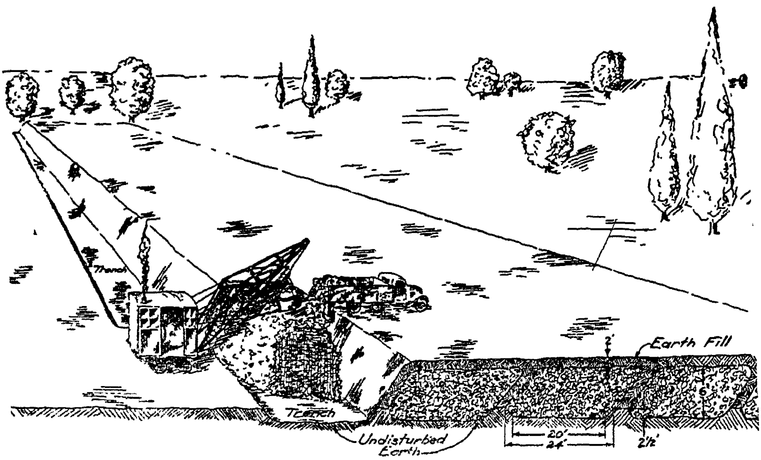
An option had been obtained for 120 acres of farm land lying in a sparsely settled district but within two miles of the city limits. A protest petition was filed with the city commission, signed by people living as far as three miles away from the proposed site. These people could hardly be blamed, for they expected us to dump the garbage in the same manner the old company had for so many years—combining the use of an old, inefficient Dutch oven type of incinerator, which merely warmed up the garbage, and a straight dumping into trenches of garbage from homes located outside the city limits, without covering it. To argue was useless and we didn't try, but immediately laid our plans to use a part of the city sewer farm. However, this location was three miles farther away, necessitating a longer haul.

Since some of you may some day want to begin this system for your city, I will describe a method of getting started, with a perfectly flat field as the disposal site.

Construction of the Fill

A sketch of the plant appears below. Consider the entrance to the fill to be just off the right-hand side or near the lower right-hand corner of the sketch. For the main piece of equipment, a good used one-half yard P. & H. shovel was purchased with a drag line bucket and boom extended to a length of 40 feet.

Operations were begun several hundred feet from the main road rather than immediately adjacent to it. A ramp was constructed



Sanitary Fill at Fresno, California

running up to 3 or 4 feet in height by digging a ditch or trench 3 feet or more in depth and piling the dirt to form the ramp at one side. The trench was from 20 to 24 feet in width and the ramp was wide enough to allow the trucks to swing and back up to dump their loads into the trench.

If you will refer to the sketch again you will see that instead of a dump body a chain laid on the bottom of the truck is pulled by the shovel to move a false tail gate which slides the garbage into the trench. Naturally, a truck with dump body could be used if desired. The shovel then levels off the garbage and compacts it by dropping the bucket on the pile of garbage. Then we are ready to begin covering. A second trench is dug parallel to the first trench and adjacent to it, as shown in the sketch, and the dirt from the second trench is spread on top of the garbage and is compacted by allowing the bucket to drop

on top of the earth covering. The depth of the garbage in these first and second trenches was increased to continue the slope of the ramp until a depth of about 8 feet of garbage was reached. The fill was then leveled off. As shown in the sketch, a compacted and settled cell of garbage is about 6 feet in depth.

In our opinion the depth of the compacted earth covering should be not less than 24 inches and it is just as necessary to cover the side slope thoroughly. By simply cutting the trench deeper it is possible to get as much dirt as needed.

About the time one of the trenches has been filled, a motor patrol grader from the street department runs out to the fill and further levels off the top of the last trench so that the trucks can easily drive on the completed fill, turn, and back onto the last completed trench at the far end of the fill, where a new trench is begun. If there is no motor patrol grader handy, an ordinary drag may be used to good advantage.

There are certain aspects of the job that may involve operating difficulties. It is definitely advisable to grade the top of the fill so as to have quick drainage from the rains. This is not difficult to do. Naturally the system works better in a sandy soil than in a clayey one and you will have more difficulties in locations where you have severe winters. However, rain, snow, and cold have their compensations. Rain would prevent fires in the trenches if it were impractical to cover them immediately.

Because of experiences at other locations I felt that rats would present quite a problem and we were prepared to cope with them. Very shortly before operations began, the state sanitary inspector arrived, at my request, to advise us about rodent control. After studying our proceedings carefully, the inspector stated that by using an earth covering of sufficient quantity and depth we were taking the best possible precautions against rodents. Our experience shows that rats will not burrow through much more than 6 inches of earth and practically never through as much as 12 inches. Ground squirrels and some other small animals may burrow for greater distances and it is wise to watch regularly for their holes so as to keep the rats from having any chance at all to exist at the fill. However, our method of smoothing and dragging covers any such holes promptly, the state inspector makes regular calls, and as far as I know no one has ever seen a rat at our disposal fill.

Public Support Is Secured

After about two and a half years of operation of the fill at the sewer farm the people of this locality were able to see for themselves the highly sanitary type of job we were doing. We had planted quite a number of trees and taken precautions to keep the fill clean and neat. We encouraged visitors and had classes from the schools and college, city engineers, city managers, and other city officials visit the site quite frequently. By means of newspaper advertisements and real estate agents the owners of property of a certain area were invited to submit their property for sale to the city for use as a disposal site. Bids were received on seven or eight different parcels, which were then appraised. In several cases prices were lowered to meet the appraisals, and the best site of the group was selected. Since so many of the property owners in this district offered their land for sale to the city as a disposal site, these persons were then in no position to protest the use of the site selected, as they had three years earlier.

A 90-acre site was purchased and operations were begun as before, beginning the work several hundred feet back from the main road. The present site is only three miles from the city hall, has been in use for two and a half years. The only complaint received came from some people living on a very small farm about a mile away, who said that large rats from our fill were bothering them. This complaint was immediately relayed to the chief sanitary inspector of the state, whose men investigated and found the source of the rats to be in the neighborhood of the small farm and not in the disposal fill.

During this five-year period, we have taken advantage of many opportunities to get publicity in our local press concerning the operations of our waste disposal department. That, together with increased and courteous service, has made the people of this city not only conscious, but proud of the waste disposal system. Instead of being a subject to be hushed up, it has been particularly praised by the housewife, all of which has helped tremendously in the matter of public relations.

Maintenance of the Fill

No separation of refuse is required in Fresno, nor in any of the northern California cities. The refuse as collected includes besides garbage, bottles, cans, papers, and all other miscellaneous refuse including tree and lawn trimmings. A charge is made for this service at the rate of 45 cents a month for one collection weekly of 30 gallons of

mixed refuse, or 80 cents a month for two collections weekly. In addition, one collection monthly is made for the 45-cent customer, and two collections monthly for the 80-cent customer, of all garden rubbish such as prunings of trees and shrubs, grass cuttings, etc. There is no limit to the quantity picked up under this service.This free service, which has reached surprising proportions, was not given by the old company and has resulted in the alleys and vacant lots in the city being kept quite clean.

In the fiscal year 1938-39 we collected 110,000 cubic yards of refuse for which a charge was made, and 67,000 cubic yards of the garden rubbish above described, for which no charge was made. These figures are for an average of 13,000 customers. The weight of the mixed garbage and refuse averages about 440 lbs. per cubic yard; the rubbish about 266 lbs. per cubic yard. Most of the rubbish is at least partly combustible and, as it is collected by trucks that do not at the same time haul garbage, we are dumping it at present at the street sweeping department dump and setting fire to it. Inasmuch as this dump has been in operation for thirty years there are no complaints. However, it is not necessary to dump the rubbish there. For several years we dumped it at the sanitary fill, covering it all.

It is very important that no fires be allowed at the sanitary fill, if we are to keep them sightly, odorless, and subject to no complaints.

When we were disposing of rubbish as well as garbage in the depth shown in the sketch, we were covering about six acres a year. At present we have increased the depth of the trenches to 3 to 4 feet, increased the covering when compacted to nearly 36 inches and increased the depth of the garbage, when compacted, to nearly 8 feet. We are now covering four and one-third acres per year.

We are now sowing the top of the old fill at the sewer farm to grain and next year expect to sow alfalfa. It will be better farming land than it was before the fill was started. With the increased coverage at the present fill, the city will have its choice in years to come of putting on another layer of refuse, or using the present 36-inch covering again, and I see no reason why a third layer could not be put down, using the same covering. All the land will be just as good, if not better, farming land than it was at first.

Many persons feel that the soil will be better for farming purposes because of the decomposition of the garbage. However, I do not make this as a point. Temperature tests have been carefully made over the five-year period. They show that the temperature within the fill

rapidly increases after sealing, to the point 20° above the temperature of the surrounding soil. This peak is reached in about ten days, and after thirty days the temperature curve drops and rapidly flattens out until after nine or ten months the temperature is the same as that of the surrounding soil. This would tend to show that complete decomposition has been accomplished in that period of time, which is further borne out by studies showing that all settlement has occurred at the end of the ten-month period.

Further settlement is to be expected if heavy irrigation is used on the fill. In the eastern part of the United States, however, the heavy rains should assist in effecting practically complete settlement within two years.

Test holes dug in that part of the fill now five years old show all of the garbage to be gone except some grapefruit and similar rinds. Near the top of the fill and also near the bottom of the fill where some moisture has had its effect, the tin cans are rusting. Further into the fill the tin cans are still quite shiny and you can read the labels on the cans quite clearly. Newspapers are very legible and no mold is noticeable on the papers or magazines. Probably in localities subject to great rainfall the rusting of cans would extend further into the fill. Mr. John J. Casey, City Engineer of San Francisco, reports the findings in their sanitary fill to be practically the same as ours.

At first we let a contract to a junk dealer to pick over the dumped refuse in the fill. I believe he was to pay the city about $35 a month. He soon complained that our manner of disposal prevented his salvaging any quantity of junk. Also, he soon had the site so cluttered up with boxes of bottles, piles of cardboard and papers, and fenders, that I urged that his contract be canceled, and this was done. It is my belief that if you wish to have a really sanitary fill it is difficult to carry on salvaging operations. If your salvage is of great value I am sure that all of you are ingenious enough to work out a plan for handling it.

Some Data on Costs

You will want to know about the cost of this method of disposal. Including the salary of the shovel operator, all maintenance, repair, and operation costs, and depreciation of the shovel, together with a complete write-off of the purchase price of the land at $125 per acre, the disposal cost is 24 cents a ton. It is not really fair to include a complete write-off of the purchase price of the land, for reasons above stated, but such inclusion keeps our figures on the safe side.

Below are some tables which I believe will be of interest. In considering the cost shown, it is well to keep in mind that union scale wages are paid to the shovel operator, truck drivers and helpers, and mechanics. Also, in making a comparison with other types of disposal, such as incineration, reduction, etc., you should remember you add to our figure the cost per ton for hauling the refuse beyond the distance to the incinerator or reduction plant which in most cases is located within the city limits.

Operations were begun October 15, 1934, with 8,400 customers being served, or 54 per cent of the total residences. We borrowed $30,000 from the city water department to commence operations and repaid the loan with 4½ per cent interest in eleven months.

As of June 30, 1939, there were 13,532 customers being served, or 85 per cent of the residences.

PROPERTY ACCOUNTS

Motor vehicles	$22,804.19
Disposal plant equipment	3,294.11
Field equipment and small tools	1,015.33
Office furniture and fixtures	2,055.92
Buildings and structures	11,534.53
Land	19,075.00
Total	$59,779.08
Less reserve for depreciation	19,074.55
	$40,704.53
Net worth as of June 30, 1939	$56,451.54

OPERATING STATEMENT

FOR THE YEAR JULY 1, 1938, TO JUNE 30, 1939

INCOME

Service Revenue	$119,239.68
Paper Sales	3,290.16
Miscellaneous	346.60
Permits (Swill)	450.00
Total	$123,326.44

OPERATING EXPENSE

Gathering Cost:	
Payroll	$61,943.10
Truck Operation	4,279.71
Truck Maintenance	2,237.99
Miscellaneous	10,165.13
	$78,625.93
Disposal Cost:	
Payroll	$4,272.00
Operation	2,153.19
Miscellaneous	805.26
	$7,230.45
Administration:	
Payroll	$17,372.90
Miscellaneous	5,514.62
	$22,887.52
Total Operating Expenses	$108,743.90

Total Cost per Ton of Refuse

Gathering	$2.37
Disposal	.22
Administration	.69
	$3.28

Note: For 100 per cent depreciation of land at Disposal Fill add 2c to cost of disposal.

Total Refuse Collected

Total Tons of Mixed Garbage	24,306
Total Tons of Garden Refuse	8,905
Total Cubic Yards of Mixed Garbage	110,482
Total Cubic Yards of Garden Refuse	66,955

I believe there definitely is a place for incinerator and reduction plants in the study of systems of garbage and refuse disposal. But just as the improvement of incinerators invites further study of their use, so does the improvement of the sanitary fill. In summing up I want to reiterate that I am talking about a *sanitary* fill, and to suggest:

1. That the garbage be covered as soon as possible, and within 24 hours.
2. That not less than 18 inches of earth be used for coverage, on the side slopes as well as on the top.
3. That no burning whatsoever be allowed on the site of the sanitary fill.
4. That visitors be encouraged to visit the fill to observe the work being done, and that you give thought to publicizing the work of this department.

DISCUSSION

John S. Flockhart

Principal Asst. Engineer, Bureau of Street Cleaning, Newark, N. J.

It is evident from Mr. Vincenz' paper that with the proper degree of care sanitary fill disposal can be successfully practiced.

Because of the relatively low cost of the method, many municipalities fortunate enough to have suitable land within short hauling distance of the collection area have found that when properly controlled the sanitary fill dump is a solution to the disposal problem. The objectionable features such as unsightliness, disagreeable odor, rat and vermin nuisance, and smoke from fires, all of which generally characterize the common dump, are absent. Gone too, are the confusion

and wrangling caused by the salvaging of refuse material by junk dealers during the period of dumping operations. With respect to this latter point, Mr. Vincenz is frank in stating that salvaging interfered with dumping, and so it was stopped.

The Fresno authorities were apparently dissatisfied with the old system of disposing of city wastes and were determined to eliminate the objectionable features. They were fortunate in having land suitable for the sanitary fill method within reasonable hauling distance and in being able to start with well defined ideas of sanitary operation. That they have been successful in their efforts is shown by the results accomplished.

The general subject of the land fill method is attracting a great deal of attention recently, with many articles appearing in current public works and sanitation magazines, both for and against it. The agitation of citizens in one case, that of New York City, has resulted in the matter's being brought into court, and the appointment by the Surgeon General of the United States of a committee of five health experts to study the methods of dumping in Queens County will result in a far-reaching decision as to the health and nuisance aspects of the various systems.

As Mr. Vincenz states, the study of systems of disposal should not be confined to one type. Improvements in incineration, reduction, and land fill will be made, and the choice of the proper type for the particular community depends on the factors encountered.

In considering the cost of the method, both the initial cost of the land and the operating expenditures should be examined and then compared with the costs of other systems. A forward look into the future to visualize the results accomplished and an evaluation of the site or plant at that time will assist in the determination of the system to be employed.

DAVID W. GODAT

Maintenance Engineer, Division of Public Works, New Orleans, La.

FROM Mr. Vincenz' presentation, it is apparent that this method of disposal is well adapted to the conditions encountered at Fresno, and has resulted in a material saving to the residents of that city.

However, I am still at a loss to understand why I was asked to discuss a paper dealing with the sanitary fill method of disposal. As

you perhaps know, New Orleans is an "incineration city" and has been for the past twenty-three years. This does not mean, however, that we are so prejudiced in favor of incineration as to have no interest in other forms of disposal. However, since my actual experience in disposal has been limited to incineration, my thoughts on the subject of the sanitary fill are purely academic and are, in consequence, based on thought rather than experience.

My primary concept of refuse disposal, regardless of method, is a system or process by which garbage and mixed refuse is positively and completely destroyed in a reasonable time. Let us look at the sanitary fill method to see if this system complies with such a concept.

First, the method depends, if I am correctly informed, on the anaerobic decomposition of the putrescible elements in garbage, to reduce it to a harmless inert ash. It is evident that the rapidity of such decomposition is dependent upon a reasonable admission of air. Garbage, as we all know, is relatively high in moisture content, which runs anywhere from 50 to 65 per cent by volume. Such refuse is also high in volatile matter as is evident from the very strong odor which occurs when such material is left uncovered for any length of time.

As this material decomposes, the water separates out, and, being heavier, should drop to the bottom of the trench, while the volatile gases rise and seek a means of escape. It is evident, therefore, that unless the plant is located in a sandy soil, the accumulated water will soon reduce the covered trench to a sodden mass, impossible to truck over.

As described by Mr. Vincenz, the refuse is compacted by dropping the bucket on it, and subsequently again by the heavy trucks which must cross the earth cover to reach the new trench. Therefore, it would appear that this compacting, so essential to the continuance of the system, must necessarily retard the decomposition of the refuse.

Now, I am going to risk a statement which I am sure will be challenged, but if my arguments are refuted by facts about which I have no knowledge, the resulting interchange of thought will be well worth it to me, and perhaps to you.

I do not think that mixed refuse under such conditions will be totally destroyed in five or even in ten years, and in consequence the surface of the fill will not reach its final compaction for many years. And further, I think that such subsidence will not be uniform if mixed garbage and rubbish are placed in the same trench.

In substantiation of this, I offer the following: when ordinary

mixed garbage and rubbish are incinerated, the resulting ash will weigh anywhere from 15 to 20 per cent of the weight of the original refuse. If, therefore, a ton of mixed refuse were completely destroyed, there would result approximately 400 lbs. of residue. Now, since the weight per cubic yard of mixed refuse is about 400 lbs. per cubic yard, there would be 2000 ÷ 400 or 5 cubic yards to each ton.

For the decomposition of each cubic yard of mixed refuse there would then result $\frac{1}{5} \times 400$, or 80 lbs. of ash. Now, since ash will weigh from 800 to 1200 lbs. per cubic yard (and using 800 lbs. per yard as a measure), the volume of residue per cubic yard of mixed rubbish destroyed would then be $\frac{80}{800}$ or $\frac{1}{10}$ of a yard. Theoretically, therefore, a 10-foot fill would shrink to a depth of 1 foot, if destruction were complete. This is approximately correct.

The fact that test holes dug five years after the fill was placed disclosed unrusted tin cans, and papers whose print was still quite legible is, of course, evidence, that decomposition was only partial. It is probable, however, that all putrescible material, dangerous to health and offensive to the senses, did decompose within that period. The other, or so called inoffensive material may, therefore, be said, to be merely buried and not in any sense disposed of.

If the sanitary fill is used to dispose of tree prunings and other bulky material such as bed springs, old stoves, auto fenders, and such noncombustible rubbish, it would appear that this would have to be deposited in a separate trench so as to prevent further unequal settlement.

Digressing a moment, there are several other interesting items which arise in my mind in connection with the use of the sanitary fill, and upon which I should like further enlightenment. First, what disposition is made of dead animals such as dogs, cats and mules?

Second, what disposal service is afforded to stores and business establishments whose production of noncombustible trade waste is larger than the limited quantity collected by the city?

In conclusion it appears to me that the sanitary fill method is limited to areas where loose sandy soil is available and where rainfall is not too plentiful. It appears further that such a method is not positive and does not completely destroy the refuse, but merely affords a place where decomposition of putrescible material proceeds slowly and where other objects are just buried from sight beneath the ground. Some of these will ultimately decompose while other noncombustible matter such as metal, bottles, glass, and so forth, will remain buried

for an unknown time. Such a method is not to my mind comparable with incineration, reduction, and the other older forms of modern disposal.

MR. VINCENZ: From what Mr. Godat has said, this decomposition that has occurred is the reason we got such strong odors when we opened up the sealed part to excavate. However, that was nothing but the gas escaping from the decomposition that had taken place and did not mean that it was still decomposing.

I am not going to argue about the settlement over a hundred-year period, and certainly no one would want to build a large structure on that fill without adequate foundation. However, we believe that this disposal method is quite satisfactory for our purposes.

San Francisco has a population of about 700,000, their weight of mixed garbage runs almost exactly the same as ours, and their charges are higher. The garbage is hauled to a railroad yard, dumped into gondolas, and taken to the sanitary fill which is eight miles out of the city. They are dumping about 25 feet deep and making a good coverage. Because they are bucking rock their cost is higher than ours, running around 50 to 55 cents a ton.

MR. G. R. THOMPSON (Detroit, Mich.): What do you do about the rat breeding menace?

MR. VINCENZ: I mentioned before that we do not have any rats. Our complete coverage prohibits rats from coming through. We have never seen a rat on the fill.

MR. A. PAV (Berwyn, Ill.): We are troubled with gas explosions. Do you have anything like that?

MR. VINCENZ: No, we do not. I think if you will put on more coverage you will get away from it. We keep that gas in by use of a drag.

MR. E. J. CLEARY (New York, N. Y.): There is another factor in regard to the rat menace. I believe Mr. Vincenz mentioned at one time that the temperature in his fill increased 20°, but in New York City they have a temperature increase at a depth of six feet of 140°. In some places it is over 212° and steam comes out of the test holes. I think a rat wouldn't find that a good place to live.

However, New York City is not content with that and has hired the outstanding rat authority to make a study of the whole rat problem. The whole question of fill in New York City hinges upon that report. Also, New York University is cooperating with the city in making a thorough study of the land fill operation. They are

making a gas analysis, studying temperature, bacteria, and the other factors involved. They are also making a study of the amount of coverage needed to take care of the decomposition adequately.

New York does not seal the front, but I notice that Fresno makes an air-tight seal. That additional compaction helps to drive out the air that might be there and accelerates decomposition—which is not as fast as one might expect, particularly for such things as cellulose and rags. That is why if you dig that up later you may find papers and rags and other material of that nature.

MR. L. E. DEMPSEY (Greensboro, N. C.): If you do have a fire how do you put it out?

MR. VINCENZ: With water. We have an old well near by with an electric hook-up on it. We pump an irrigation ditch to the site and flood it.

MR. DEMPSEY: Our dump is a half mile outside the city and every time I attend one of these conventions our dump gets on fire. It is 10 to 40 feet deep and we put ashes and automobile bodies and everything that won't burn in there and cover it with ashes. Unfortunately, we don't have a water line to the dump. When it catches on fire, the fire gets underneath and by the time we get a hose there the fire has a pretty good start. The only way we have been able to put it out is by moving the dump with a steam shovel.

MR. W. E. ROSENGARTEN (Ardmore, Pa.): We spread our burnable material on top and set fire to it once every three days, pushing the burned material over the top. We have been doing that for the past ten years.

MR. A. W. XANTEN (Washington, D. C.): I suggest that you make your ditches a little more shallow, so you will have less opportunity for fire.

MR. G. M. BOWERS (Richmond, Va.): We have had the same trouble as Mr. Dempsey but now no dump can be established until a water connection is put in. The dump is kept under constant supervision with definite responsibility. It is now a well controlled dump.

MR. R. L. ANDERSON (Winnetka, Ill.): Mr. Vincenz described the sanitary fill in a warm climate and all of the other places where I have heard of it have been in mild climates. What is your reaction to the establishment of a fill in a cold climate where there is frost all winter?

MR. VINCENZ: I realize my lack of experience in that connection and believe that someone else more familiar with it should answer

that question. However, I should imagine that you might be able to turn the snow and rain to your advantage.

MR. G. E. HESSELBACHER (Elkins Park, Pa.): We have a number of township dumps and we had a volunteer fire department to fight dump fires. After some experience in that connection we found that the volunteer firemen didn't like the job, and since I placed the chief of the fire department on the dumps there have been no fires to fight.

MR. C. D. WARNER (Detroit, Mich.): We used to have a lot of fires, but in the last two or three years we have cut up the automobile bodies, large cans, drums, and material of that kind, and we have not had any fires.

MR. JOHN S. FLOCKHART (Newark, N. J.): We rely on the same things as the gentleman from Richmond, and those are an adequate water supply and supervision—the two things that control dump fires.

When we established a central dump it was necessary for us to protect that dump in every way possible. At the present time we are collecting from 4,000 to 4,500 cubic yards of material every day and hauling it two and one-half miles from the center of the city. In order to protect the dump we have water lines to it, and with W.P.A. assistance we have built macadam roads so that we have easy access to them. The mains are about 6,300 feet apart so that wherever we are dumping we have adequate water protection.

Because the dump is very large it is necessary for us to have a watchman there at all times, and he takes care of any fires that develop. However, if the fire gets beyond control the firemen are called out. Up until two years ago they did not like to bring their apparatus down there, as it was very expensive. Since these roads were built, thirty to forty acres have been regraded and converted into baseball fields. We are also planting shrubs and trees and transforming it into a park.

We have a different type of fill than that developed in Fresno, and for that reason I was much interested in Mr. Vincenz' paper. I was wondering just how he could do it out there, but with the explanation of the sandy soil and the amount of rainfall it has been made more clear to me.

Our initial fill is six to eight feet and then we compact that material to about four feet with a ten-ton tractor.

MR. DEMPSEY: What do you take on the dump?

MR. FLOCKHART: We take everything with the exception of trade waste and that means ashes, garbage, and trash. We have not had

occasion to take any automobile bodies as they are all taken to the private dump. We don't accept them.

MR. BOWERS: We found it particularly hard to fight fires or to reduce the number of fires when we had a dump of considerable height, say of about forty feet. We now go to the bottom and work up in terraces, filling six or eight feet and working back and up. We never let our dump get a long slope, because when we did that we had dump fires. However, as I stated before, we have overcome all of our fires by supervision and an adequate water supply.

Maintenance and Operation Problems

A Round Table Discussion

CHAIRMAN PHILLIPS: As you know, following the discussions of Mr. Vincenz' paper, the schedule outlined in the program calls for the balance of the afternoon being devoted to an informal discussion of maintenance and operation problems. To start off, I have several questions that have been submitted. First, however, I would like to say that I am very enthusiastic about the manner in which this meeting is going forward.

Mr. Vincenz is interested in getting some information about the collection of leaves. What do you do in Minneapolis, Mr. Paul?

MR. PAUL: We handle our leaves just like street sweepings. I suggest that you call on Milwaukee for more information about that as I believe they are much more familiar with that type of collection. We put them in our regular dumps with street sweepings.

MR. VINCENZ: I would like to know how they are loaded.

MR. R. L. ANDERSON (Winnetka, Ill.): We load our leaves with a street sweeper. We collect anything that is in the street but the property owner has to burn any of the leaves on the property.

MR. J. E. MCGLAMERY (Tampa, Fla.): Last year we inaugurated a system of giving the leaves to residents who might want them for their fruit trees, etc. We pick them up with a sweeper and each day people call in and want a load of leaves in a certain location. The driver of the truck is given the addresses of the people in that vicinity who want leaves and he dumps them at the closest address. We dis-

posed of 1,100 loads of leaves in that way. We load them in our regular trash trucks with a scoop shovel.

MR. A. W. XANTEN (Washington, D. C.): We have about 120,000 curb trees in Washington which give us a lot of leaves. We have gone into this matter rather thoroughly, but we have never reached any satisfactory solution. Our method is to use large gangs with baskets and a good-sized truck. The leaves are scooped into the baskets and then are dumped into the truck. We also supply the leaves to anyone who wants them, and quite a few people do. We have not tried to burn them in the incinerator.

MR. PAUL: Milwaukee has made a commercial enterprise out of it. They pile them into long trenches and then after three years they are able to take out a material that is saleable. They are getting around twelve dollars a ton for it.

MR. G. H. SANDENBURGH (Ann Arbor, Mich.): We deliver all of our leaves to the superintendent of parks. He puts a little sludge and the leaves through a hammermill, allows that to stand for a year or two, and then uses it for fertilizer. The City of Parma has developed a suction machine for loading leaves. The city engineer said it works very well and has considerably reduced their costs of collection.

CHAIRMAN PHILLIPS: We have a great many trees and we are proud of them. We permit the burning of leaves on the streets, and even encourage it, as our streets are nearly all paved with brick. We even have been guilty of burning some ourselves. We save ourselves some money in that way. However, we do haul away the residue. Whenever we pick up the leaves we push all of the leaves into the gutters and then load them by hand into a dump truck.

MR. A. C. WILLIAMS (Haverford Twp., Pa.): I rigged up an apparatus much similar to a snowplow. Because they are much easier to load when they are wet, we wait for a rainy day and then push them all into the gutter.

MR. S. M. WEAVER (Montclair, N. J.): Our street foreman put something like a snowplow across the front of a truck, with a series of pushbrooms underneath. When they have a big pile of leaves gathered they load them into a truck.

CHAIRMAN PHILLIPS: I have another question here. How do you handle complaints from irate residents about loud smelling manholes in the center of the street, on a combined sewer system, during a three- or four-week rainless period in the summer when windows are open and much front-porch-sitting is indulged in?

MR. A. PAV (Berwyn, Ill.): We have had trouble with that and when we receive complaints we usually go out and dump some lime in the sewer to show that we are trying to help them. That is about all you can do except pray for rain.

MR. F. T. PAUL (Minneapolis, Minn.): It does not seem to me that you should have any trouble in that connection. I know we don't have any.

MR. P. L. BROCKWAY (Wichita, Kan.): We have a lot of odors from the sewers and all we do is to seal up the manholes. We have done that for a number of years.

CHAIRMAN PHILLIPS: How about catch basins?

MR. K. J. KNAPP (Rochester, N. Y.): We have had trouble with catch basins mostly in sections where the housing did not have a vent pipe going to the roof. We have a combined sewer system, and have installed several gas valves to keep the gas from coming out of the inlets. At the present time we don't have any catch basins in Rochester, they are all inlets, and that helps to ventilate the sewer through the stacks going to the roofs of the houses.

MR. C. A. WALLS (Oak Park, Ill): Isn't the answer to that problem to get the cooperation of the water department so that they will go around periodically and flush their mains during a particularly dry period, in that way sealing the catch basins?

MR. W. E. ROSENGARTEN (Ardmore, Pa.): We have two types of manhole covers, some with holes and some without. Where there is a complaint that odor is coming up through the manhole cover, we put on a cover that has no opening and try to get sufficient ventilation in other manholes that are not too close. Our system is a separate system but we empty our storm water into the Philadelphia combined system sewer. As a result, gas sometimes did back up through our storm water system and we tried to use trapped inlets. However, we have trapped the main right where it enters Philadelphia and now are doing away with the trapped inlets elsewhere.

CHAIRMAN PHILLIPS: What do you do about the control of roaches and crickets on refuse dumps? Has anyone the solution to that problem?

MR. W. H. ROBERTS (Rochester, N. Y.): Last fall before the frost came in one of our city dumps we had a plague of crickets and they even invaded the houses. A group of indignant women got together then and chased us out of the dump. We tried burning it and we tried a preparation that the health bureau devised for us but that didn't

help. We weren't able to do anything about them until the cold weather came.

MR. F. T. PAUL (Minneapolis, Minn.): We have had the same difficulty and we got rid of them by having a complete dirt coverage 10 inches deep.

CHAIRMAN PHILLIPS: We have a question here on steps. When grades are too steep for vehicle travel, steps are frequently used. What is a maximum grade for a highway for vehicles? What type of construction is used for steps? How many steps are desirable in a flight? What grade is permissible on walks? What can be said in regard to steps versus winding walks?

MR. R. E. HARRIS (Pittsburgh, Pa.): We have charge of the design and maintenance of concrete steps. I don't know the maximum grade for paved streets, but we have some over 20 per cent. However, we try not to have any over 20 per cent for sidewalks. On steeper grades we put in steps, either jump sidewalks or regular steps. The maximum number of rises in any one flight is sixteen. After that we try to get a landing.

Also, we try to have a flight and platform on only two supports rather than three. Many times in order to do that we have a platform of four to six feet, and we don't put another bed under it. That avoids cracking from uneven settlement.

Lately, in order to cut down the number of rises, we have put our platforms on a 10 per cent grade between the flights. We have adopted as a standard a 6½-inch riser with a 12-inch spread. This is used on 90 per cent of our steps, and gives us a very easy support for the ordinary burden.

We use carborundum grain surface on the steps and platforms. At first we covered the whole step with carborundum grain but in the last couple of years, to cut down the cost, we have just covered an area six inches wide from the edge of the riser and one foot less than the total width of the step. We have a standard drawing which shows the design for flights under various conditions, to avoid making up a design drawing for every job. In general we find that this standard drawing will cover nearly all conditions that arise.

MR. D. W. GODAT (New Orleans, La.): Do you have any trouble with people using those steps for firewood, if you use wood?

MR. HARRIS: We do when they get into disrepair, but if they are kept in good shape, they are not torn apart. We did have some new railings torn down but they were in an outlying district. However,

we have found that if the steps and railings are kept in good repair they will not be molested, but once they begin coming loose, they will go fast.

CHAIRMAN PHILLIPS: We have lost steps, railings, and everything else when they have been in perfect condition, but we have been successful in eliminating all of that now.

MR. O. L. KING (Abington, Pa.): How wide are the steps?

MR. HARRIS: We have some four feet wide and others as wide as eight feet, but the average step is five feet wide.

MR. G. M. BOWERS (Richmond, Va.): What is your policy about removing trees in order to accommodate businessmen to display show windows or for an entrance to a gas station?

MR. C. M. GREENE (Dearborn, Mich.): We remove trees whenever requested if we find the circumstances warrant it. We have found out that in most cases the owner will endeavor to delay the removal of a tree and to save it by careful planning. However, if necessary we take it out at the city's expense.

MR. W. A. HEIMBUECHER (University City, Mo.): Our city engineer tries to get the owner to change his driveway if it is for a gas station so that the tree will not have to be removed. If it is an owner of a building I don't have any difficulty, especially if he is one of these speculator builders who is building a house to sell. I stand pat on not removing the tree for a driveway and most of the time I get my way.

The big filling stations make a very detailed survey of the lot they propose to put their station on and then arrange their pumps and driveway entrance so as to save the trees if possible. As a result it may mean the removal of only one tree. We don't permit more than a 30-foot curb cut for driveways, that is, 30 feet with two 3-foot turns, giving him 25 feet back of the sidewalk crossing. If a man wants more than that he has to put in two driveways.

CHAIRMAN PHILLIPS: Is it necessary to take trees out at the expense of the city for the construction of some privately owned utility?

MR. HEIMBUECHER: Where necessary they are taken out at the expense of the city.

MR. L. C. WHITSIT (Highland Park, Mich.): I think where it can be shown that the tree is a serious obstruction the city council permits the removal of the tree. However, no tree can be removed without that consent.

MR. W. P. COTTINGHAM (Gary, Ind.): We are removing a lot of poplar trees that are giving us some trouble with our sewers. We

have to furnish the supervision and equipment and the W.P.A. is removing them. On a street-widening job the tree is removed by the city and given to the property owner if he wants it.

MR. W. J. GALLAGHER (Rock Island, Ill.): We have taken down about 1,600 trees in the past two years under the method just mentioned, using W.P.A. labor, and we have had very satisfactory results. If the tree is standing on private property, we do not take the tree down without the consent of the property owner, unless it is for some public improvement.

CHAIRMAN PHILLIPS: In our city we make a great ceremony in permitting the removal of a tree. We think quite a bit of our trees and dramatizing them discourages many people from removing them. In no case do we allow a driveway entrance to gasoline stations to exceed 25 feet, and we don't hesitate to tell them about it whenever we are approving gasoline station plans. When we are forced to remove a tree for a private purpose, we either insist that the property owner do it under our supervision, or we take it down and bill him for it.

MR. G. M. BOWERS (Richmond, Va.): In my town we have a tremendous population of 60,000 trees in a 25-square-mile area. We have two factions to deal with in our city. The merchants want the trees removed in order to give them more display for their signs but the Garden Clubs are fighting them. Recently we removed 32 trees in three blocks in an outlying retail section because all of the property owners asked for the removal of the trees. Then when the trees were cut down the Garden Clubs rose up in great protest. As a result of that controversy we do not remove any trees now unless public improvement demands it. When we do receive such a request, we publish a notice to the effect that the tree is to be removed and that anybody objecting to its removal will be given a hearing. It is a public issue now.

MR. W. A. HEIMBUECHER (University City, Mo.): Did you ever try trimming the trees higher?

MR. BOWERS: We did that but it was not enough for them and they wanted the trees removed.

MR. HEIMBUECHER: What kind of trees were they?

MR. BOWERS: They were elm trees and well matured, probably 30 or 40 years old.

MR. HEIMBUECHER: I was faced with the same situation but they were satisfied when the trees were trimmed. We also had a lot of trouble with our street lighting in that connection and one of the

trustees wanted to know what could be done to eliminate the difficulty. I suggested cutting off all the low branches so the tree would grow higher. In less than five years the tree branches had spread up higher with heavier branches and arched over the street, and now it is one of our finest streets with ample light and plenty of air. The air used to be very bad down there because of the low-hanging branches.

CHAIRMAN PHILLIPS: I think you will find in almost any community with any civic pride that you can resist the desire to remove trees on the part of an individual by a little bit of public sentiment.

MR. J. T. CAMPBELL (Philadelphia, Pa.): Every engineer loves a tree and we save every tree we can, but a life is more valuable than a tree, and whenever a tree obstructs the vision or in any way makes it dangerous, it is removed.

MR. F. T. PAUL (Minneapolis, Minn.): We have a problem confronting us and that is the interference of the neon signs with the scheme of our traffic signals. We have very little control over the type of signs people put up.

CHAIRMAN PHILLIPS: Do you have a sign control ordinance?

MR. PAUL: We are attempting to get one put through now, but at the present time we do not have one.

MR. A. PAV (Berwyn, Ill.): We were confronted with a situation like that and now our electrical inspector passes on how far out a sign may extend from a building. If the sign to be erected is close to a traffic signal, he has the full authority to let him know whether it is going to interfere with the traffic light.

MR. G. H. SANDENBURGH (Ann Arbor, Mich.): We have an ordinance covering that.

MR. T. R. KENDALL (New York, N. Y.): What are you going to do with the neon signs that form a background for your traffic light? I have seen that happen in a number of cities. It is not a question of a sign's sticking out from a building but one that forms a background for the traffic signal. Isn't it possible to put a backboard behind the traffic signal to make your signals stand out? When you do that you will probably have a complaint from the store on the corner because you are blocking his sign. However, the streets should be made safe in all particulars, regardless of complaints of that sort.

MR. H. L. HOWE (Rochester, N. Y.): We had a series of red neon signs that interfered with the traffic signal and so we put up a background behind our sign to make it clearly visible.

MR. W. A. HEIMBUECHER (University City, Mo.): We have an ordinance thirty years old which does not permit a sign to extend beyond the property line more than three feet, and says no sign can be erected without a permit from the building commissioner. When he receives a request for a sign that might in some way conflict with our traffic signals he consults our engineering department. I think the answer to the whole question is to get a strict ordinance.

CHAIRMAN PHILLIPS: However, if you give somebody discretionary powers for the installation of a sign you will have pressure being put on him from various sources. I think it should be a hard and fast rule that works everywhere with no discretionary power to anyone.

MR. HEIMBUECHER: If a request is received for a sign that might interfere with the traffic signals, then the engineering department can take that into consideration. Our board has always insisted that we stay on the side of the public safety.

MR. SANDENBURGH: We should be very careful in giving permission for the erection of these signs. It may be that a sign two blocks down the street is the one that interferes with your traffic signals.

CHAIRMAN PHILLIPS: I think the trend in the United States today is very much toward the curtailment of projecting signs. You may not be familiar with the fact that twenty-odd cross-town streets along the Great White Way have eliminated projecting signs at the request of the merchants themselves. Fifth Avenue has a maximum allowable projection of one foot; Allentown, Pennsylvania, allows one foot, and any number of cities are eliminating projecting signs or practically legislating them out of existence. We have cut our limits from eleven to six feet and we hope to get below that pretty soon.

MR. L. C. WHITSIT (Highland Park, Mich.): I think the solution is the prohibition of red neon in the signs. That color is particularly objectionable because it is supposed to mean danger, and if we continue to see these signs we will lose the value of red as a danger sign.

No sign can be recognized in Highland Park near a traffic signal unless it has been submitted to the police department for approval. I advocate the elimination of all projecting signs, and I think we should prohibit the use of red neon for advertising purposes. Red should be used as a danger signal only.

MR. D. B. BISER (Baltimore, Md.): What is your practice with regard to refuse collection? I have three questions I would like to ask.

1. Do you make an extra service charge for the collection of refuse from your department stores, etc.?

2. Do you collect refuse piled on the curb, not put in containers of any kind?

3. Do you sprinkle and sweep your streets at night, and if so, do you make it a strict rule not to clean the streets until after the refuse has been collected?

MR. W. H. ROBERTS (Rochester, N. Y.): We have placed a limit of six barrels a week which we will collect without charging. For anything in excess of that we charge five cents a barrel.

In regard to the piled-up refuse, we will not take anything that is not in proper containers.

Our refuse collection is made during the daytime and we start our street flushing at the outskirts of the city and work in toward the business section, so that that flushing is done after midnight.

MR. J. S. FLOCKHART (Newark, N. J.): The amount of material collected is regulated by an ordinance and, where it amounts to more than it should, the material must be removed by the person responsible. He must hire a private contractor for that. There are times when the city will make some collections at cost, but they are very rare.

The city has men call on people who put refuse out in improper containers and if necessary they are brought into court. We have been fairly successful in getting full cooperation in the downtown area.

We don't do very much flushing but what there is we try to do the day after the collection is made.

MR. BISER: The department store has a considerable amount of combustible material, but refuse from the chain drug stores is a mixture of garbage with some combustible trash in it. We are taking it all in the one collection, but I have been wondering how some of the other cities have been handling that.

MR. L. E. DEMPSEY (Greensboro, N. C.): In our city the property owner sets the garbage out on the curb on the day of the collection and the Garden Clubs are objecting very strenuously. I would like to know what percentage require cans to be set out on the curb and how many pick them up from the back yard.

CHAIRMAN PHILLIPS: We collect everything from the back yard and it is never in sight.

MR. DEMPSEY: I think the set-out set-back system is just as good as setting it out on the curb. Our residential section sets it out on the curb every Monday, Wednesday, and Friday. The business section is also collected, but we make a charge for it.

MR. W. A. XANTEN: In Washington we have insisted that refuse not

be placed at the curb but at the building line and up against the building, or just back of the front-yard fences in as inconspicuous a place as possible.

In connection with the mixed refuse produced by drug stores, etc., we do not collect rubbish from business places in Washington. However, we do provide a place for disposal. The businessmen are given the privilege without charge to haul all of their combustible refuse to our incinerator plant.

The drug stores did not like to separate their garbage and they disposed of that material by dumping it on privately owned dumps. However, these dumps have been closed up and they now have to separate their refuse. We render a garbage service but they must deliver the burnable refuse.

Field Engineering

WALTER STARKWEATHER

District Civil Engineer, U. S. Coast Guard, Seattle, Wash.

(Chairman of and Reporting for the Committee on Field Engineering*)

THE following bibliography of articles and books for the year 1939 considered of interest in field engineering reflects most of the trends which have received the greatest attention during this period.

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* COMMITTEE ON FIELD ENGINEERING, 1940

Walter Starkweather, Chmn. .... *Seattle, Wash.*
Lloyd Aldrich ...... *Los Angeles, Calif.*
Herbert M. Dibert .... *Troy, N. Y.*
Robert H. Randall .... *Washington, D. C.*
Frederick T. Thorpe, Jr. *Philadelphia, Pa.*
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BUSINESS PROCEEDINGS OF

AMERICAN PUBLIC WORKS ASSOCIATION

Meeting of Board of Directors

Pittsburgh, Pa. *May 27, 1939*

A MEETING of the Board of Directors of the American Public Works Association was called to order by President Brown at 10:30 A.M., on May 27, at the William Penn Hotel in Pittsburgh. Those present were: J. S. Flockhart, R. L. Phillips, W. J. Galligan, J. E. Root, H. L. Howe, F. R. Storrer, W. E. Rosengarten, W. B. Shafer, F. W. Herring, and N. Hebden.

Auditor's Report

The executive director presented the auditor's report for the fiscal year, January 1, 1938, to December 31, 1938. The statement contained therein re membership dues receipts was explained by the executive director, and the accountant's letter verifying and balancing this account was presented. A motion was passed approving the auditor's report.

Executive Director's Service to Federal Government

The work of the executive director in the service of the federal government, as a member of the Public Works Committee of the National Resources Committee, was explained and described. It was moved and seconded that the executive director be authorized to take leave of absence at such times as are necessary to participate in the work of that committee. The motion was passed unanimously.

Publications

The executive director reported on the publications which have been issued by the Association since the last Board meeting. These publications were: *Specification on Concrete Pavements* (January), *Sewer Rentals* (March), *1939 Public Works Engineers' Yearbook* (May), a revision of the *Brick Pavement Specification* (May), and a revised Table of Contents for the volume of *Standard Specifications.*

F. R. Storrer reported that the City and Regional Planning Committee has undertaken a study on standardizing subdivision regulations and planning, to enable engineers to better judge subdivision projects.

HOTEL FOR 1939 PUBLIC WORKS CONGRESS

William B. Shafer, chairman of the Local Arrangements Committee for the 1939 convention, reported to the Board on his recommendation of the William Penn Hotel as headquarters for this meeting. A motion was passed that the William Penn Hotel be designated as convention headquarters as recommended by Mr. Shafer.

1939 CONVENTION PROGRAM

The Board discussed the problem of appointing and announcing the nominating committees responsible for proposing the candidates for Division chairmen; and the schedule of division meetings. The general consensus was that the nominating committees, including the general nominating committee for proposing Association officers, be appointed prior to the opening session and announced to the delegates immediately following the opening formalities. Also, that the business meeting of each Division be held at the opening of the session for which it has been made responsible; the nominating committee of that Division to report at that time and the election of the Division chairman to follow immediately.

It was decided that each of the Association's Divisions would be made responsible for one of the sessions during the congress. The Maintenance and Operation Division was assigned the session on Monday afternoon, October 9; the Design and Construction Division the session on Tuesday morning, October 10; and the Administration Division the session on Wednesday morning, October 11.

President Brown suggested, and it was agreed, that Board members in the region within an easy overnight trip from Pittsburgh would write personal invitations to city engineers and directors of public works within that area to attend the convention, and that those Board members would assume the responsibility for greeting these men and introducing them to other delegates.

President Brown also suggested that all of the Board members meet at the registration desk early on Monday morning, October 9, to greet the delegates as they register.

The general outline of the program and the selection of program topics was then taken up and a lengthy discussion ensued.

CONVENTION ENTERTAINMENT

The Local Arrangements Committee chairman, Mr. Shafer, out-

lined to the Board members a number of suggestions relative to the delegates' entertainment at the 1939 Congress. Following his report, it was the consensus of the Board that the entertainment features be left to the judgment of Mr. Shafer.

The annual banquet is scheduled for 7:30 P.M. Tuesday, October 10. The banquet will be set up for dinner dancing and a dance will be held following the banquet.

Exhibits at Convention

Discussion was given by the Board to the exhibits at the convention and an inspection of the convention floor layout was made. It was recalled that at the previous meeting of the Board of Directors it was decided that the sale of exhibits would be primarily the responsibility of the local committee, with the cooperation of the headquarters office. The proposal was made that the headquarters office endeavor to dispose of exhibit space first to our regular exhibitors; there is room for about sixteen exhibits at most and this procedure should take care of from six to eight booths. The remainder of the space would be sold by the local committee.

Souvenir Program

The local committee chairman reported to the Board that he had not as yet taken up the matter of a city appropriation for the convention and that, therefore, the question of the use of a souvenir program is still in doubt. The souvenir program will be necessary only if there is no city appropriation made.

Committee Work for 1940 Yearbook

The executive director explained the current procedure in regard to the reports of the Association's standing committees for the Yearbook. In the past it has been customary to have each committee report on the events and developments in its field during the last calendar year. This has not worked out very satisfactorily and the executive director suggested that in the future the standing committees be assigned or instructed to select a definite topic for a report instead of an "annual review" to be included in the Yearbook. It was the consensus of the Board that the President with the advice of the executive director shall set up whatever committees seem necessary and shall determine what treatment Yearbook material should be given.

The meeting adjourned at 6:00 P.M.

Meeting of Board of Directors

Pittsburgh, Pa. *October 8, 1939*

The Board of Directors of the American Public Works Association met on Sunday, October 8, at the William Penn Hotel in Pittsburgh, Pa. President Brown called the meeting to order at 7:15 P.M. Directors present were J. S. Flockhart, F. T. Paul, R. L. Phillips, H. L. Howe, W. E. Rosengarten, and F. R. Storrer. Guests included P. L. Brockway, G. B. Gascoigne, E. S. Rankin, W. W. DeBerard, S. C. Lovett, G. M. Shepard, M. Evans, and M. Rosen.

It was moved and seconded that the following actions taken by President Brown since the last meeting of the Board of Directors be approved: the appointment of S. C. Lovett of Pittsburgh as chairman of the Local Arrangements Committee to succeed William B. Shafer who died suddenly in June, 1939; postponement of the election of a Director to replace Mr. Shafer until a successor could be elected at the annual meeting in October to fill out his unexpired term; and the selection of ten members to receive the Veterans' Award at the 1939 Public Works Congress. The motion was passed.

The executive director presented his annual report for the period September 1, 1938, to August 31, 1939, which was read and approved.

Invitations to hold the 1940 Public Works Congress were presented and received from the following cities: St. Paul, Cleveland, Newark, Washington, Baltimore, Jacksonville, Detroit, Dearborn, and Chicago. It was agreed that these invitations would be filed for consideration at the winter meeting of the Board of Directors, at which time the convention city would be selected.

In view of the absence of H. D. Bradley and L. G. Lenhardt, chairmen of the Maintenance and Operation and Administration Divisions of the Association respectively, a motion was passed authorizing the president to appoint chairmen to substitute for them at the forthcoming business meetings of those Divisions.

President Brown then introduced S. C. Lovett, chairman of the Local Arrangements Committee, who explained the arrangements that had been made concerning the convention. The Board congratulated and thanked Mr. Lovett for the excellent work he had done.

The meeting adjourned at 9:45 P.M.

Report of Executive Director

THIS report covers the period September 1, 1938, to August 31, 1939, and with the exception of the appended financial statement the statistical data reported are for those twelve months.

CORPORATION BUSINESS

The annual report of the corporation for the year 1938 was submitted to the Secretary of State of Illinois in January of this year.

The firm of Arthur Young & Company, certified public accountants, completed an audit of the Association's accounts in March and copies of their report were submitted to the President and Treasurer of the Association and to the Executive of the Spelman Fund.

A complete report of the activities of the Association for the year ended December 31, 1938, was prepared upon the request of the Executive of the Spelman Fund and submitted to him in March. Copies of this report were also made available to the Board of Directors at that time.

In response to an application submitted to them in November, 1938, the Spelman Fund of New York announced on January 18, 1939, that they had made an appropriation to the general budget of the Association of $40,000 for the calendar years 1939 and 1940.

In February the Spelman Fund of New York announced that it had granted an appropriation of $18,000 to our Association for our research program, for the period March 1, 1939, to March 1, 1941.

MEETINGS OF BOARD OF DIRECTORS

Three meetings of the Board of Directors were held during the year under report, one on October 5, 1938, in New York, one on November 26, 1938, in Chicago, and one on May 27, 1939, in Pittsburgh. The principal items engaging the attention of the Board at the October meeting were the status of several of the standard specifications then in process of revision and the establishment of a policy in regard to travel expenses of members of the Board of Directors. At the November meeting the Board selected Pittsburgh for the 1939 Public Works Congress, instructed the executive director to make application for financial assistance to the Spelman Fund of New York, and adopted the operating budget for the calendar year 1939. At the Pittsburgh meeting in May the Board devoted its attention largely to the program for the annual conference.

In choosing Pittsburgh for the 1939 meeting, the president appointed William B. Shafer, a member of the Board, chairman of the Committee on Local Arrangements. Mr. Shafer had made considerable progress in preparing for the annual meeting when we learned to our sorrow in June that he had died suddenly in Chicago while engaged in line of duty. A few weeks after this tragic event, the president and the executive director conferred with Frank M. Roessing, Director of Public Works in Pittsburgh, to seek his advice as to whom should be appointed chairman of the Committee on Local Arrangements to succeed Mr. Shafer. Acting upon that advice, the President appointed Sanford C. Lovett, a member of the Association, who energetically carried forward the plans laid down by Mr. Shafer.

Membership

On August 31, 1939, the total enrolled membership of the Association was 710, which included 609 members fully paid up in dues or paid up in advance, and 101 members in arrears from six to twenty-four months. On September 15, 1939, 40 of these delinquent members, who were in arrears for two years, were removed from the roll, in accordance with the provisions of Article IX of the constitution.

Changes in Membership

September 1, 1938, to August 31, 1939

Total Membership September 1, 1938	764
Resignations	44
Deaths	9
Dropped for nonpayment of dues	68
New Members	65
Reinstatements	2
Net Loss	54
Total Membership September 1, 1939	710

Analysis of Paid-Up Membership

August 31, 1939

Senior, Life, and Honorary members	35
Paid to March 1, 1941	1
Paid to September 1, 1940	44
Paid to March 1, 1940	107
Paid to September 1, 1939	422
TOTAL	609

Analysis of Delinquent Membership

August 31, 1939

Paid to March 1, 1939	11
Paid to September 1, 1938	36
Paid to March 1, 1938	5
Paid to September 1, 1937	49
TOTAL	101

The membership figure of 710 is to be compared to a figure of 764 on the same date last year, a net decrease of 54. There were 65 new members elected, 2 members reinstated, 44 resignations accepted, 9 deaths reported, and 68 members dropped for nonpayment of dues. The decrease of 54 members is to be compared with a net decrease of 48 members during the year ending August 31, 1938. Obituary notes are appended to this report.

Classification of Membership

August 31, 1939

City Engineers, Directors of Public Works, Other Municipal Officials having equivalent degrees of responsibility	210
Assistant City Engineers, Bureau Heads, Other Municipal Officials	189
County, State, Federal, and Special District Officials	40
Consulting Engineers	112
Professors, Editors, Public Utility Engineers, and noncommercial organization officials	62
Commercial	73
Miscellaneous	24
TOTAL	710

Although the total membership figure shows this decrease, the number not delinquent in dues shows an increase, 609 against 597 a year ago.

Furthermore, an analysis of the 710 members, when compared with a similar analysis made a year ago, discloses the fact that despite our net decrease in membership we have increased by 21 the number of city engineers, directors of public works, and other municipal officials having equivalent degrees of responsibility. Also, we have increased by 9 the number of cities represented in our membership by ranking public works officials.

U. S. Cities Represented in Membership

Population Group	Number of Cities in Group	In A.P.W.A. by Ranking Public Works Officials	Cumulative Number of Cities	Cumulative Number of Cities in A.P.W.A.	Cumulative Per Cent
500,000 and over	13	11	13	11	85
300,000 to 500,000	12	6	25	17	68
200,000 to 300,000	16	6	41	23	71
150,000 to 200,000	11	5	52	28	54
100,000 to 150,000	41	13	93	41	44
75,000 to 100,000	26	11	119	52	44
50,000 to 75,000	69	22	188	74	39
25,000 to 50,000	189	33	377	107	28
10,000 to 25,000	606	40	983	147	15
2.5 to 10,000	2183	15	3166	162	5

During the entire year under report, a closely formulated system of membership promotion by mail has been followed. This system has operated as follows: each month a new group of prospects was selected and sent a letter of invitation to membership. These prospect lists were built up from a number of sources, including persons who attended the 1938 Public Works Congress, those whom we have been able to serve by answering inquiries, those who have purchased our publications, those newly appointed to office, and so on. During the second month each of these prospects received a letter from a member of the Association, seconding the invitation to membership. During the third month he received a letter from a different member, also supporting the proposal that he become a member. During the fourth month, a clean-up letter was sent in an effort to clear the prospect file.

During the year this involved the preparation of 335 individually typed opening letters to prospective members, and 235 letters to existing members asking for their cooperation in carrying out this campaign. About 100 members cooperated with us in this way.

In addition to the membership program described above, letters inviting to membership were sent to all city engineers, directors of public works, and street superintendents in the country in October, 1938, and in August, 1939.

There were 65 new members enrolled this year as compared with 45 new members enrolled last year.

Financial Status

There is appended to this report a statement of the receipts and disbursements of the Association for the eight months ended August 31,

1939. This statement includes the budget figures established by the Board of Directors at its meeting in Chicago in November, 1938. Careful study of the statement indicates that the expenditures for the remaining month of the calendar year can be kept within the estimated revenues.

Yearbook

The 1939 Public Works Engineers' Yearbook was given publication in May. Following the pattern established by the 1938 Yearbook, the volume included both the Proceedings of the 1938 Public Works Congress and a considerable amount of material especially prepared for Yearbook publication. This special material was assembled with a view to presenting briefly the most salient developments in the public works field during 1937. This material was prepared by the standing committees of the Association, members of the Association, and specially qualified students of the public works field not represented in our membership.

Research and Publication

Standard Specifications for Public Works Construction, one of the major publications of the Association, was extended during the year by the inclusion of a new specification for sewer construction, in November, 1938, and by a specification for portland cement concrete pavements, in January, 1939. These specifications were prepared by the Association's specifications committees having responsibility over those two fields. The present loose-leaf format of the standard specifications was put to good use in June, 1939, when a revision of the brick pavement specification was made which involved only one printed page. Shortly after the publication of the portland cement concrete pavement specification an order was received for 2,000 copies of that specification specially printed for the Portland Cement Association.

The long awaited study of sewer rentals and the attendant administrative problems, a study conducted in cooperation with the American Municipal Association and the Municipal Finance Officers' Association, was given publication in March, 1939. The reception of this publication by the field has been extremely favorable, resulting in a demand which has just about depleted our stock.

Since the completion of *Sewer Rentals,* all of our research efforts have been concentrated upon the study of refuse collection and disposal practices. With the approval of the chairman of the Commit-

tee on Refuse Collection and Disposal it was decided to give publication to this study in two volumes, a first volume on refuse collection practices and a second volume on refuse disposal practices. This procedure has the double advantage of avoiding the production of a book too bulky to be handled conveniently and of allowing earlier publication of one of the volumes.

Detailed data on the collection practices of about 200 cities have been assembled and analyzed. Of that number more than 30 have been visited by the Research Director and have yielded even more comprehensive and detailed practice data. Preparation of tentative drafts of the chapters of *Refuse Collection Practice* has been in progress for several months, based upon the study of the data that have been assembled. Visits to cities along the northeastern seaboard have been deliberately postponed until after these tentative drafts have been completed so that a final field trip might be relied upon to fill in any blind spots in the assembled data.

The total number of publications distributed by the Association for the year ended August 31, 1939, was 4,679, not counting the News Letter. The News Letter circulation for the year was 18,189. The distribution of our major publications during the year under report was as shown in the following table:

DISTRIBUTION OF MAJOR PUBLICATIONS

September 1, 1938 to August 31, 1939

	Sold	Free	Total
1938 Yearbook (published May, 1938)	35	94	129
Street Cleaning Practice (published September, 1938)	302	768	1070
Sewer Rentals (published March, 1939)	364	318	682
1939 Yearbook (published May, 1939)	132	658	790
Standard Specifications (complete edition)	73	19	92

INQUIRIES

The number of inquiries on public works practice received during the year by the headquarters' office totaled 145. This compares with 143 received during the preceding year. Many of these inquiries involved extensive searches in the library and examination of municipal reports.

Last year I reported that of the 143 inquiries referred to at that time, only 41 were received from members of the Association. It is

interesting to note that of the 145 inquiries reported herein 62 were received from members.

The subjects of these inquiries were as follows:

Organization and Personnel	7
Finance, including Sewer Rental	13
Equipment and Materials	8
Refuse Collection and Refuse Disposal	44
Street Cleaning, including Snow Removal	7
Streets and Roads	4
Traffic	5
Sewerage and Sewage Disposal	17
Water Supply	10
Recreation	4
Miscellaneous	26
Total	145

Field Work and Miscellaneous Activities

In January, 1939, the National Resources Committee (since succeeded by the National Resources Planning Board) established a Public Works Committee under the chairmanship of Henry M. Waite, a member of this Association. The executive director was appointed vice-chairman. The committee consists of eleven members, six of whom are federal officials and five from outside the government service. The committee was assigned the threefold task of carrying forward the programming of federal public works undertakings, encouraging state and local public works programming, and studying the economic effects of various types of public works expenditures. In carrying out this assignment, the Public Works Committee set up three subcommittees, with the executive director named as chairman of the subcommittee responsible for the encouragement of state and local public works programming.

In approaching this phase of the Public Works Committee's assignment, the subcommittee decided that the first step necessary was to establish a method by which local programming could be undertaken, to be followed by the publication of a manual of procedure which could be used by a local official for that purpose. It will be noted that this operation is identical with an item the Association has carried upon its proposed research program for several years. The situation thus presented is that of the federal government financing an undertaking which the Association had hoped it might be able to deal with at some time in the future.

Experimental and demonstration work in local and state public works programming is now drawing to a close and several drafts of a manual of procedure have been written. Serving the federal government in this way has absorbed an appreciable share of the executive director's time. Travel expenses, however, are reimbursed by the federal government and per diem compensation is paid for each day spent upon the work. The resultant saving in the Association's salary payment to the executive director has had a beneficial effect upon the Association's budget.

In March the executive director delivered a lecture to a graduate class in engineering at New York University on "Public Works Organization," at the request of Dean Saville of the Engineering School. During the early part of 1939, the executive director served as chairman of a special examining committee for the city of Evanston, Illinois, assigned the task of examining the candidates for the post of city engineer of that community. Loran D. Gayton, city engineer of Chicago, another member of the Association, also served on that committee.

In May the executive director addressed the National Planning Conference in Boston, Massachusetts, on "Future Shares of Federal and Non-Federal Agencies in Financing Public Works."

In the same month, he addressed the Mid-Atlantic Section of the Society for the Promotion of Engineering Education at Swarthmore, Pennsylvania, on "Preparing Engineering School Graduates for Public Service."

The research director, while on one of his field trips, met with the City Engineers' Section of the California League of Municipalities in Berkeley, California, and addressed them on the activities of the American Public Works Association.

The research director has also been serving as instructor in a correspondence course in public works administration operated by the Institute for Training in Municipal Administration sponsored by the International City Managers' Association.

Early in the year the research director visited Montclair, New Jersey, to consult with the chairman of the Committee on Refuse Collection and Disposal. While there he also conferred with the city officials on departmental organization and cost accounting procedures.

The assistant director attended the public works section of the Missouri League of Municipalities at Columbia, Missouri, in May, 1939, and addressed them on the activities of the Association.

The executive director and the research director were engaged for a brief period by Public Administration Service to assist in making a survey of the public works activities of Huntington, West Virginia, for the government of that city. They were also engaged for a short time in a similar undertaking at Peoria, Illinois.

The chairman of the Association's Committee on Traffic Control represented the Association in a cooperative enterprise in operating the National Institute for Traffic Safety Training held at the University of Michigan in August.

Annual Reports of Chapters

CHICAGO CHAPTER

The Chicago Chapter held its first regular dinner meeting during the 1938–1939 year at the Chicago Engineers' Club on February 9, 1939. Following his opening remarks, Paul Hansen, president of the Chapter, introduced Stanley Pinel, research director of the A.P.W.A., who spoke on "What the American Public Works Associaciation Is Doing." Through the courtesy of the Massachusetts Institute of Technology, two interesting motion pictures were shown of the developments in high-speed photography. Dr. F. W. Godwin, of the Armour Institute of Technology, then presented an excellent paper, illustrated with slides, on the spark photography developed at the Armour Research Foundation.

On Friday evening, June 9, 1939, the Chapter held its annual dinner meeting at the Georgian Hotel in Evanston. Immediately following dinner, a short business session was held at which time the following officers for the ensuing year were elected:

Henry B. Bleck	President
Roscoe C. Doyle	First Vice-President
Wesley W. Polk	Second Vice-President
Robert L. Anderson	Secretary-Treasurer

Upon the conclusion of the business meeting, Norman Hebden, Assistant Director of the A.P.W.A., discussed the elements of management as applied to the administration of public works activities. The other speaker of the evening was Earl H. DeLong, chairman of

the Civil Service Commission of Evanston, who gave a most interesting talk on the subject of a career in management. A lively period of open discussion followed.

The secretary-treasurer reported a balance in the Chapter funds of $328.39 as of August 31, 1939.

METROPOLITAN PHILADELPHIA CHAPTER

THE activities of the Metropolitan Chapter during the past year included well attended monthly meetings from October to May inclusive, with the main event being the Twenty-sixth Annual Dinner, held in January. More than 200 public works engineers and municipal officials in this area were present at the dinner, where the sports talk by James J. (Jimmy) Dykes, Manager of the Chicago White Sox, added to the enjoyment of the evening. Other speakers appearing on the program were Wilhelm F. Knauer, Director, Department of Supplies and Purchases, Philadelphia, and I. Frank Gaskill, Sales Manager of the Philadelphia Electric Company. The Hon. James C. Crumlish, Judge of Common Pleas Court No. 7, Philadelphia, was a splendid toastmaster.

Walter E. Rosengarten, Township Engineer, Lower Merion Township, Pennsylvania, Past President of the Chapter and a Director of the American Public Works Association, was awarded the gold medal presented each year by the Chapter for meritorious service. Frank W. Herring, Executive Director of the American Public Works Association and a welcomed guest at many of our annual dinners, presented the medal and read the citation accompanying the award.

Credit for much of the success of the annual dinner goes to the Dinner Committee composed of Samuel S. Baxter, Chairman, Ben H. Joseph, Herman Krohn, Albert W. Moser, Joseph A. Singer, and Frederick T. Thorpe, Jr.

The interest of the chapter members in the affairs of the national Association is shown each year by the large attendance at the Annual Public Works Congress. At the 1938 Congress in New York last October more than 26 members and guests were present. Elmer T. Transeau, Assistant Director, Department of Public Safety, Philadelphia, (chapter member), and the Chapter President took prominent parts in the Congress program.

A most encouraging sign is the interest shown at the monthly meetings of the Executive Committee, where the plans and policies

of the Chapter are formulated. The President wants to thank each of the officers and directors for the fine support given him during the year.

A great deal of credit for the fine attendance at the meetings goes to Frederick T. Thorpe, Jr., Chairman of the Public Relations Committee, and John H. Hunter, 2nd, who again gave of his time and efforts in the preparation of attractive posters advertising the meeting. Chairman Thorpe is to be particularly complimented on the splendid reports of the meeting which were printed in the Public Works Engineers' News Letter.

Albert W. Moser, Chairman of the Meetings Committee, and the members of his committee deserve a great deal of credit for the entertaining and instructive series of meetings they arranged for the Chapter. The average attendance at the meetings was 75. The roster of meetings for the year was as follows:

Speaker	Subject
October 1938: Messrs. Buckley, Baxter, Moser, Thorpe, King, Kramer, Rosengarten, Hunter, Hopkins, Krohn and Mitchell.	*Panel discussion featuring the high lights of the New York Convention.*
November 1938: Messrs. Buckley, Baxter and Moser.	*New trends in Land Sub-Division Controls.*
December 1938: Christmas Party.	*Moving Pictures, food and drink.*
January 1939: 26th Annual Dinner	*Splendid talks, food and drink.*
February 1939: F. A. Pitkin, Executive Director	*Review of work of Pennsylvania State Planning Board.*
Geo. R. Copeland, Assistant Director	*Engineering Aspects of Pennsylvania's State Planning Program.*
Roy Helton, Statistician	*People as the Basis for Planning.*
Willis Wissler, Planning Economist. (All of the Pennsylvania State Planning Board.)	*Determinant of Population Pattern and of Governmental Requirements.*

March 1939: Messrs. Buckley, Baxter, Moser, Shaughnessey and MacDonnell.	*Problems of Municipal Administration and the Proposed Philadelphia charter.*
April 1939: George H. Kaithern, Dist. Plans Engineer, Pennsylvania Department of Highways.	*Reconstruction of the Roosevelt Boulevard.*
May 1939: James B. Kelly, Executive Director; Dorothy P. Schoell, Director, Research and Information; and Walter H. Thomas, Technical Director. (All of the Philadelphia Housing Authority.)	*A discussion of the "housing plans" of the Philadelphia Housing Authority.*

During the year the Executive Committee appointed Charles A. Bareuther, Engineering Examiner of the Civil Service Commission, to Second Vice-President and Paul MacMurray, Field Supervisor, Bureau of Highways and Street Cleaning, to the Executive Committee to fill the position vacated by Mr. Bareuther.

Economic conditions necessitated the dropping of many city employees and unfortunately some Chapter members were included. This unfortunate circumstance reduced the Chapter membership below last year and seriously interfered with the procurement of new members. During the year one Junior Member joined the Chapter.

At the request of the Engineers Club of Philadelphia for Chapter representatives on the Council of Affiliated Societies, Council of Affiliated Societies Membership Committee, and the Technical Service Council, the President appointed Edward J. Dauner, Charles P. McDermott, and George T. Shegog, respectively.

At the March 1939 meeting the President appointed Messrs. Bareuther (Chairman), Thorpe, Masterson, Lyons, and Rosengarten as the Nominating Committee to prepare nominations for the annual election of officers for the ensuing year. At the Executive Committee meeting prior to the April meeting, Mr. Bareuther presented the selections of the Committee as follows:

Robert A. Mitchell	President
Charles P. McDermott	Third Vice-President
Joseph C. Gibbs	Secretary

Frank L. Thomas	Treasurer
Alan Corson John H. Hunter, 2nd Herman Krohn Oliver L. King	Directors (to serve three years)

After compliance with the provisions of the by-laws, the above nominees were duly elected at the May 1939 meeting.

The report of Frank L. Thomas, Treasurer of the Chapter, submitted at the May meeting of the Executive Committee, is as follows:

Receipts, Cash on hand deposited in Saving Fund Society of Germantown and Vicinity	$120.33
Expenditures for May Meeting	4.08
Cash on hand deposited in saving fund	$116.25
Additional balance in two closed bank accounts	$312.63

President Robert A. Mitchell deeply appreciates the honor bestowed upon him by his election to lead the Chapter for another year and wants to assure the members that with their support he will do all in his power and within his means to make the next year an even more successful one than the past.

MICHIGAN CHAPTER

The annual meeting of the Michigan Chapter was held on November 17, 1938, at the Fort Shelby Hotel, Detroit, in connection with the Michigan Municipal League convention. The public works section comprised 34 members of the Association and other public works officials in Michigan. Officers were elected as follows:

John H. Moorhouse	President
T. Fred Older	Vice-President
H. A. Olson	Secretary-Treasurer
Edward S. Clark	Executive Committee
Samuel C. Jacka	Executive Committee
Harold Corson	Executive Committee

Featuring this program was a discussion of public works operating problems by Colonel E. D. Rich, Chief Engineer, State Health Department; C. A. Sirrine, Deputy Administrator, W.P.A.; and Stanley Pinel, A.P.W.A. staff. Gadgets developed by public works officials to assist them with their special problems were displayed, including a

leaf loader developed by Ypsilanti, curb and gutter making machine developed by Kalamazoo, and a manhole cover buffer to eliminate rattle, developed at Coldwater.

Prior to the annual meeting the executive committee met twice to formulate plans for the program, and also with Murray D. Van Wagoner, State Highway Commissioner, to discuss the distribution of gasoline and weight tax revenues in Michigan.

On June 23, 1939, 13 public works officials, including several members of the Chapter, held a conference at Crystal Falls, principally to discuss W.P.A. rules and regulations.

The executive committee met on August 16 to consider plans for the next annual meeting and delegated several members to meet with a group of engineers and public works officials in the Detroit area who have been getting together informally for six or eight months. At the meeting held the following day in Dearborn, 18 Chapter members were present and invited the group, at such time as they saw fit to affiliate with any organization, to become a part of A.P.W.A. A committee consisting of F. W. Liddle, Wyandotte, C. D. Warner, Detroit, and John Moorhouse, Highland Park, was appointed by the chairman of the round-table group to consider this matter. No action was taken at that time.

The annual meeting in 1939 was held on September 14, at the Columbia Hotel, Kalamazoo, with 38 public works officials present, including 12 members of the Chapter. The program included the report on the work the Chapter has been doing relative to gasoline and weight tax distribution to municipalities, a discussion of new forms developed and required by W.P.A., the new Michigan act concerning the recording of plats, and an inspection trip to observe the operation of a curb and gutter making machine developed by the city engineering department of Kalamazoo, and a sewer cleaning, turbine type machine developed in the city engineering department at Monroe. Several W.P.A. projects in process of construction were also visited.

The officers for 1939–40 elected at the annual meeting were as follows:

George R. Thompson	President
T. Fred Older	Vice-President
H. A. Olson	Secretary-Treasurer
Robert E. Neis	Executive Committee
Alfred Eckert	Executive Committee
R. V. Terrill	Executive Committee

At the 1938 Public Works Congress of the A.P.W.A. one of the members of the Michigan Chapter, Edward S. Clark, city manager of Kalamazoo, was given the Veterans' Award Medal.

There were 33 active members in the Michigan Chapter of A.P.W.A. at the end of the period under report. Refunds amounting to $92.50 were made to the secretary-treasurer.

NEW ORLEANS CHAPTER

The activities of the local Chapter have been seriously handicapped during the past year as a result of the untimely death of the President, A. F. Theard. Three of the members were dropped for non-payment of dues, and with one death the present membership is 24, with 3 members whose dues are in arrears.

The total receipts during the year were $64.00, which, added to the amount carried over from last year, gives a total of $201.66. Expenditures during the year amounted to $76.72, leaving a balance on hand of $124.94, out of which the expense of the annual meeting is to be paid.

At the annual meeting the following officers were elected to serve for the coming year:

A. G. Wyler	President
N. L. Marks	Vice-President
A. H. Guillot	Secretary-Treasurer

ROCHESTER CHAPTER

The Rochester Chapter of the American Public Works Association, still the youngest Chapter of the Association, received official approval of the formation of this Chapter by the official Boards of the two preceding societies, on September 21, 1936. At the meeting of the Chapter held on March 31, 1937, changes in the by-laws of the local Chapter were made to provide for the change in name from the Rochester Chapter of the American Society of Municipal Engineers and the International Association of Public Works Officials, to the Rochester Chapter of the American Public Works Association.

Since the last annual meeting of the Rochester Chapter, held May 23, 1938, the Executive Committee has held four official meetings, the business at such meetings dealing mainly with the discussion of the

affairs of the Chapter so as to promote the objectives of the American Public Works Association and the planning of the program for the regular meetings of the Chapter.

During the fiscal year the Rochester Chapter held four regular meetings.

At the meeting of November 28, 1938, the principal speaker of the evening was Howard Shafer, Manager of the Municipal Airport, who spoke on the past, present, and future of the Rochester Municipal Airport.

Harold S. Rand, Supervisor of the Rochester Housing Survey Committee, spoke on the housing surveys in the blighted areas in Rochester at the next regular meeting, held February 27, 1939.

At the next meeting of the Chapter a symposium or panel discussion was held on the work of the Operation and Maintenance Division of the Public Works Department of the City of Rochester.

The speaker at the annual meeting of the Chapter, held May 22, 1939, was Franklin J. Bonner, who spoke on the work of the Monroe County Regional Planning Bureau, mentioning particularly the policy of the Bureau in taking advantage of a foreclosure of lands for nonpayment of taxes in the county, so as to acquire rights-of-way for future streets, etc.

At the annual meeting the Auditing Committee reported on an examination of the report of the Treasurer. This report showed that the net worth of the Rochester Chapter as of May 22, 1939, was $299.97, before deducting the expenses of the annual meeting.

The number of members reported at the last annual meeting was thirty-three, including one honorary member, Edwin A. Fisher.

During the year the Chapter dropped five members for nonpayment of dues, and four resigned.

The following officers were elected at the annual meeting for the year 1939–40.

Kenneth J. Knapp	President
H. R. Moulthrop	First Vice-President
A. H. Wagener	Second Vice-President
Henry L. Howe	Secretary-Treasurer
John V. Lewis	Additional members of Executive Committee
Harry Cramer	
H. Remington Kohler	

Meetings of the Association Divisions

THE THREE Divisions of the Association—the Administrative Division, the Design and Construction Division, and the Maintenance and Operation Division—each met during the annual convention and elected a chairman for the ensuing year. (The chairman of each Division serves as a member of the Board of Directors.)

The following were unanimously elected chairmen of their respective Divisions: Administrative Division, W. W. Polk; Design and Construction Division, F. R. Storrer (reelected); Maintenance and Operation Division, George R. Byrum.

Business Meeting of the American Public Works Association

THE ANNUAL business meeting of the American Public Works Association was held in Pittsburgh on Tuesday, October 10, 1939. Guy Brown, President of the Association, presided.

The Nominating Committee reported its nominations for the officers of the Association and the Board of Directors as follows: John S. Flockhart, *President;* Roy L. Phillips, *First Vice-President;* Frederick T. Paul, *Second Vice-President;* Henry L. Howe, *Treasurer;* E. L. Knebes, *Director;* Albert C. Learned, for the unexpired term of *Director* of William B. Shafer, deceased; Walter E. Rosengarten, for *Director* for one year in case Mr. Howe (now a Director) should be elected to the office of Treasurer. Mr. Rankin moved that the nominations be closed and that a unanimous ballot for the nominees be cast. The motion was seconded and unanimously carried.

The executive director was called upon for his annual report, which, because of its length, he did not read aloud. (See page 221 for the text of this report.)

The necrology report was presented by the executive director as follows: The deaths of nine members of the Association were reported during the period September 1, 1938, to August 31, 1939. Notes on five others whose deaths were reported to the Association in September, 1939, are appended to this report. The nine were Joseph Warren Silliman, John R. Manion, Robert Ridgway, Alfred F. Theard,

George Oliver Tenney, George Howard Perkins, John T. Mockler, William B. Shafer, Jason W. Nemoyer.

The five whose deaths came to our attention in September—and I separate those because this is a report of the year September 1, 1938, to September 1, 1939—are Andrew F. Macallum, Gerald J. Wagner, Charles M. Reppert, Robert Cramer, George F. Fisk.

It was moved, seconded, and carried that a resolution of sympathy, properly worded by the executive director, be made a part of the official minutes of the Association and that a copy be sent to the families of the deceased. The resolution as subsequently composed was as follows:

WHEREAS, The members of the American Public Works Association have learned with sorrow of the death on September 22, 1938, of their fellow member, Joseph Warren Silliman; and

WHEREAS, He had long been active in the activities of the Association and devoted to the interests of the public works profession, now, therefore, be it

Resolved, By this Association assembled in meeting at the Hotel William Penn, Pittsburgh, Pennsylvania, on October 10, 1939, that it place on record its high esteem for Mr. Silliman as an engineer and fellow member, and its sorrow at his passing; that it extend its heartfelt sympathy to his family.

The above resolution was drafted for Mr. Silliman whose death was the first of Association members reported for the year. Similar resolutions were sent to the families of the other members who passed away during the year.

It was also voted to send a telegram to the oldest member of the Association, E. A. Fisher of Rochester, expressing regret at his absence from the meeting and hopes for his continued health and prosperity.

The meeting adjourned at 12:15 P.M.

NECROLOGY REPORT

JOHN R. MANION, died September 28, 1938, age 64, in Cincinnati. He was superintendent of the Waste Collection Division of the Department of Public Works of Cincinnati at the time of his death. He became an active member of the I.A.P.W.O. in 1932.

Education: A graduate of St. Xavier College in Cincinnati.

Experience: He was bookkeeper and part owner of the firm of Huss Brothers, Bar Manufacturers, for a number of years. In 1913 he entered the city service of Cincinnati as chief clerk of the Street Cleaning Department. In 1928 he became assistant superintendent and in 1930 superintendent of the Department of Public Works Waste Collection Division.

JOHN T. MOCKLER, died May 7, 1939, in Buffalo at the age of 51. He had retired some months before his death as acting city engineer of Buffalo. He became a member of the A.M.E. in 1928.

Experience: He had been in the city service since 1917 with the exception of two years' war service in the engineers' corps. Prior to his service with the city he was connected with the New York state engineering department.

JASON W. NEMOYER, died June 26, 1939, in Chicago. At the time of his death he was assistant engineer of the consulting engineering firm of Greeley and Hansen. He joined the A.M.E. in 1930 and was secretary of the Chicago Chapter during 1935–36.

Education: Graduate of University of Illinois, 1921.

Experience: He had been associated with Greeley and Hansen since 1921 and for the past ten years had been in charge of their construction work.

GEORGE HOWARD PERKINS, died July 31, 1938, at Cambridge, Massachusetts, at the age of 64. He was vice-president and secretary of Warren Brothers Company of Boston and was recognized as an expert in highway construction, particularly in connection with bituminous pavements and highways. He joined the A.M.E. in 1905 and became a senior member in 1935.

Education: Graduate of the University of Pennsylvania, B.S. 1895, M.E. 1896.

Experience: He was plant foreman of Warren Scharf Asphalt Paving Company 1897–1900; then plant foreman of Barber Asphalt Paving Company 1900–1901. In 1901 he entered the employ of Warren Brothers Company as plant foreman and was in continuous service of the company as construction superintendent, superintendent of refineries, director of Testing Laboratory, chief of Technical Service Department and vice-president and secretary up to the time of his death.

Robert Ridgway, died December 19, 1938, at Fort Wayne, Indiana, when en route to New York from Chicago where he had been present at ceremonies in connection with breaking ground for the new Chicago subway for which he was consultant. He was 76 years old. He maintained the headquarters of his consulting engineering practice in New York City. He joined the A.M.E. in 1902 and became a senior member in 1933. In 1930 he was the first recipient of the Greeley Veteran's Award for long and faithful service in the employ of one city. He had served New York 46 years at that time.

Honorary degrees: A.M., Harvard; Dr. Eng., Lehigh; Third Grade, Order of the Rising Sun, Japan.

Experience: From 1882 to 1884 he was connected with the Northern Pacific Railway. In the years 1884–1900 he was instrument man and later assistant engineer with the Aqueduct Commission of New York City. In 1900 after 16 years in the city service he became senior engineer and then division engineer with the Board of Rapid Transit Railroad Commissioners. In 1905 he was made division engineer with the Northern Aqueduct Department of the Board of Water Supply. Seven years later he was put in charge of construction of subway lines in New York costing $300,000,000. In 1921 he was given the title of chief engineer of Transit Commission and in 1924 that of chief engineer of the Board of Transportation. His private practice included work on subways in Japan, Boulder Dam, and the Trans-Bay bridge in San Francisco.

William B. Shafer, died June 27, 1939, in Chicago while making an inspection trip in connection with the construction of an incinerator in Pittsburgh where he was in charge of the City Refuse Division of the Public Works Department. He joined the Association in 1934 and became a member of its Board of Directors in 1938. He was also chairman of the Local Arrangements Committee for the 1939 Public Works Congress.

Education: Cornell University graduate, 1898.

Experience: For over twenty years he was connected with steel construction work. He was sales manager for the National Bridge Works of New York; vice-president of A. E. Norton Company and president of his own firm in New York City. In 1928 he became sales manager of Allegheny County Memorial Park. In 1933 he entered the service of the city of Pittsburgh as assistant superintendent of the Bureau of Highways and Sewers; within the same year he was ap-

pointed superintendent of the Bureau. In 1939 he was given the job of constructing a new incinerator and organizing a new municipal refuse collection service for Pittsburgh.

JOSEPH WARREN SILLIMAN, died September 22, 1938, age 73, in Philadelphia. At the time of his death he had retired from active service, but up to the date of his retirement in August, 1930, he was supervising engineer of the Permit Division of the Bureau of Highways of Philadelphia and secretary of the Board of Highway Supervisors of the Bureau. He joined the A.M.E. in 1932.

Education: Cornell University and Allegheny College; degree from latter, C.E., 1889.

Experience: After college graduation he was employed by the consulting engineering firm of Cole, Alvord and Shields in Chicago. Following an instructorship at Allegheny College, Mr. Silliman held positions in Duluth, Philadelphia, New York, and Wheeling. In 1908 he was appointed engineer of inspection with the Bureau of Surveys in Philadelphia. In 1912 he became associated with the Bureau of Highways.

GEORGE OLIVER TENNEY, died November 6, 1938, in Washington, D. C., at the age of 77. At the time of his death he was president of the Atlantic Bitulithic Company of Washington, a post he had held for 32 years. He joined the A.M.E. in 1913.

Experience: His early engineering and contracting experience included a private practice maintained in Decatur, Alabama, from 1886 to 1892, construction work for Chickamauga National Park, and private practice from 1895 to 1906 in Spartanburg, South Carolina.

ALFRED F. THEARD, died January 2, 1939, in New Orleans, age 73. He was general superintendent of the New Orleans Sewerage and Water Board. He became a member of the A.M.E. in 1932 and also of the New Orleans Chapter of which he was president at his death.

Experience: He did his first engineering work with A. F. Wrotnowski in 1881, followed by eight years in private practice. He began service for the city as topographical survey draftsman in 1893; later he became chief draftsman on drainage work and 1898 office engineer in charge of this work. In 1903 the New Orleans Sewerage and Water Board was formed and he continued in charge of drainage drafting.

In 1907 he was promoted to first assistant engineer; in 1914 he became principal assistant engineer, a post he held until his appointment in 1935 as general superintendent.

NOTIFICATIONS RECEIVED SINCE SEPTEMBER 1, 1939

ROBERT CRAMER, died August 2, 1939, in Milwaukee, at the age of 59. He was a consulting engineer well known in the sanitary engineering field. A former member of the Association (1925–39), he resigned recently on account of ill health.

Education: Born and educated in Austria (civil and sanitary engineering).

Experience: He came to this country in 1903, and served the Winslow High Pressure Boiler Co. as chief engineer and later the Kingsford Foundry and Machine Works of Oswego, N. Y., in the same capacity for a number of years. In 1927 he was appointed chief engineer of the Milwaukee Sewerage Commission, a position he held until 1930.

GEORGE F. FISK, died September 4, 1939, at Buffalo, age 62. He joined the A.M.E. in 1916 and was its thirty-fourth president in 1928. From 1936 to the time of his death he had been construction adviser to the United States Housing Authority.

Education: A graduate of Massachusetts Institute of Technology.

Experience: Following his college graduation he spent several years in Cuba in engineering work. In 1905 he was appointed to the city engineering staff of Buffalo with which he was associated for thirty years, as assistant engineer in charge of pavements, first assistant engineer, and finally commissioner of public works.

ANDREW F. MACALLUM, twenty-third president of the A.M.E., died August 26, 1939, in Toronto. He had retired from active municipal engineering practice. He joined the A.M.E. in 1909 and was made a senior member by special action of the Board of Directors upon his retirement in 1937.

Education: A graduate of the University of Toronto in civil engineering.

Experience: Following several years' experience with the Canadian Pacific Railway and the Canadian National Railway, he served

Hamilton, Ontario, as city engineer for six years. For sixteen years he was commissioner of work and city engineer for Ottawa.

CHARLES M. REPPERT, died September 16, 1939, in Pittsburgh, age 59. He was a past president of the A.M.E. (1933–4) and a consulting engineer of Pittsburgh. He joined the A.M.E. in 1921.

Education: Cornell University graduate in civil engineering, 1904.

Experience: In 1907 he entered the city service of Pittsburgh as chairman in the engineering department of the Bureau of Filtration. In 1910 he joined the engineering department of the Bureau of Construction as division engineer; in 1912 he was assistant superintendent; later designing engineer of the Design Division of the Public Works Department. During the World War he was associated with Morris Knowles on the design and construction of Camp Meade, Md., and was also connected with the housing division of the United States Emergency Fleet Corporation. He was connected with Morris Knowles until 1921 when he returned to city service as chief engineer of the Bureau of Engineering. After an interval of private practice he was made assistant director of the Public Works Department of Allegheny County. In 1926 he was appointed chief engineer of the Public Works Department of Pittsburgh, a position he held until 1935. For the last four years he had engaged in private consulting work.

GERALD J. WAGNER, died September 2, 1939, at his summer home at Morrison Lake, Mich. He was 53 years old and head of the firm G. J. Wagner & Co., consulting electrical engineers of Grand Rapids. He became a member of A.M.E. in 1919.

Education: University of Michigan, B.S. in electrical engineering, 1910.

Experience: In 1910–11 he was connected with the Metropolitan Street Railway Co. of New York City. In 1912 he became assistant superintendent of the Grand Rapids-Muskegon Power Co. In 1917 he was in charge of the design and construction of the Battle Creek Railroad and terminal at Camp Custer; the same year he was made superintendent of construction for the Michigan Railway Co., having charge of the third rail line from Kalamazoo to Grand Rapids and from Allegan to Battle Creek. From 1917 to 1920 he served as city engineer of Grand Rapids and later as public service director. In 1922

he established his own engineering business and served as consultant to utilities and oil companies throughout Michigan and the middle west. He was a member of the Grand Rapids city planning commission for several years.

Committee Reports

THE COMMITTEE ON REFUSE COLLECTION AND DISPOSAL

THE preparation of manuals on refuse collection and disposal is proceeding rapidly. The gathering of information is completed, two important chapters are written and in the hands of the Committee, and good progress is made on other sections.

The preliminary work of accumulating and analyzing sufficient factual information to support the statements made and to show accurately the current practice proved to be a rather gigantic task. A huge mass of essential data has been brought together, however, which will make the book of much greater value both as to accuracy and completeness than would otherwise have been possible. Information on all phases of refuse collection has been secured from 190 cities, both large and small, in all parts of the country. Canadian practice has also been covered. Rather complete questionnaires were sent out to 365 cities, of which 175 were returned—a very satisfactory response. In addition, field visits were made to 34 cities for the purpose of studying collection and disposal methods and practices and to secure data on numerous minor practices that could not be covered by a questionnaire. The cities were selected with care so that as many different procedures as possible could be observed and yet good coverage of each population group and each geographical area could be secured. Many pictures and other illustrative material were obtained for use in the book.

All the information has now been carefully tabulated and analyzed, ready for use as the various chapters are prepared. The chapter on the kind and quantity of material to be collected and the chapter on the preparation of refuse for collection are completed in tentative form and are being reviewed by the Committee. The chapters on collection methods and local conditions affecting collection are well under way.

Tentatively it has been decided to publish the manual in two parts, one on refuse collection and the other on refuse disposal. The material divides itself naturally along these lines and very little duplication will be necessary. Among the advantages of such separation are that the first book on collection can be released sooner than would otherwise be possible, the books will not be unwieldy, and they will match in appearance the book, *Street Cleaning Practice,* already published.

It is expected that the entire section dealing with collection will be in the hands of the Committee shortly after the first of the year. Publication should follow within a short time.

STUART M. WEAVER, *Chairman*
H. J. CATES
D. W. GODAT
JOHN V. LEWIS
CARL SCHNEIDER
RALPH C. TAYLOR
JEAN L. VINCENZ

THE COMMITTEE ON TRAFFIC CONTROL

SINCE 1937 the Committee on Traffic Control has been carrying on a project to increase interest in traffic engineering. The plan is to induce communities without traffic engineering to designate one of their engineers to whom all traffic engineering problems will be referred. If the right engineer is selected, he will see the opportunity, study the subject, and gradually acquire experience and skill in traffic engineering.

In carrying out this project, emphasis has been placed on certain cities and steps have been taken to build public opinion favorable to traffic engineering. On December 12, 1938, a letter was sent to 228 members of the Association in those selected cities, explaining the plan, and asking their cooperation in contacting one or more leading newspapers with the idea of making use of some of the following material:

1. A brief statement, *Traffic Engineering Needs,* which the A.P.W.A. member might care to place in the hands of a newspaper editor;
2. A brief list of typical traffic engineering accomplishments;
3. Suggested material for editorial use.

A number of replies were received from Committee members indicating that they had read the statements, had contacted the newspapers, and would be interested in receiving suggested material for a radio talk.

On February 27, 1939, with the assistance of members of the Committee, a report, *Traffic Progress in 1938,* was prepared for the current issue of the Public Works Engineers' Yearbook.

On February 24, a letter was sent to newspapermen who have attended the Traffic Safety Seminars of the C.I.T. Safety Foundation. The project of the Committee was explained to them and the material listed above was sent. Two editorials mentioning the project have come to our attention.

On the recommendation of the Committee chairman, the Association cooperated in the second National Institute for Traffic Safety Training held at the University of Michigan, Ann Arbor, August 14–26. It also cooperated in the first Institute, held last year at Ann Arbor.

An inquiry form is now being sent to communities of over 50,000 population to learn whether or not they have a full-time traffic engineer, or if a person in the engineering department is devoting part-time to traffic engineering activities.

For cities without traffic engineering service it is indicated that the Committee on Traffic Control will be pleased to furnish information regarding traffic engineering activities and its Committee project.

BURTON W. MARSH, *Chairman*
GEORGE W. BARTON
LEWIS V. BULLIS
JOHN H. HUNTER, II
EDWIN F. KOESTER
FRANK J. MCDEVITT
THEODORE M. MATSON
D. GRANT MICKLE
ROBERT A. MITCHELL
A. J. NAQUIN

THE COMMITTEE ON SEWERAGE AND SEWAGE DISPOSAL

THE Committee on Sewerage and Sewage Disposal has considered the preparation of a number of papers during the past year, and finally reduced the number to two papers that will probably be submitted for publication in the Yearbook. The first is a paper in course of preparation by Morris Cohn on the subject, "Gas Engine Economics in connection with Sewage Disposal Works." [1] Mr. Cohn has enlisted the aid of all members of the Committee and expects to cover the best available data on design, operation, maintenance, and power characteristics of gas engines used in connection with sewage disposal plants, and using sewage gas for fuel. The Committee also has under consideration a paper on the effects of air conditioning waste water on sewer system design and operation.

The Committee feels that these reports will be valuable contributions to the literature on this subject, and has made an effort to avoid the duplication of the work of other organizations as well as of work done by our own members.

Several members of the Association have felt that possibly this Committee, in some future reports, might contribute valuable data by outlining present standards of construction and design. This suggestion arose because the members felt that engineering societies generally have not given much time or space to construction features now in vogue, and that the disposal of sewage has been given practically all of the consideration.

The development of better methods and the requirements for more satisfactory sewage disposal constitute the reason for the intense interest in that subject during the last few years.

If methods of construction and problems relating more particularly to the sewer barrel are given a little more space, it is suggested that it be in the form of a symposium, and that information be included as to the experience of cities with various types of sewer construction; the structural weaknesses, if any, of certain types of construction and materials, with an explanation, if known, for the apparent weakness; rehabilitation methods used to repair or restore deteriorating sewer barrels; and other subjects of like nature.

The extension and improvement of sewerage facilities have con-

[1] See p. 82.

tinued throughout the past year and of course are to be commended. Each year many thousands of persons are added to those enjoying sanitary facilities. There are few accomplishments of society which contribute as much to the present and future well-being of mankind as proper sewerage facilities. This Association can well continue its interest and contributions in the improvement and extension of sewerage facilities.

Albert P. Learned, *Chairman*
Carl B. Carpenter
Morris M. Cohn
William C. Emigh
James L. Ferebee
John B. Hawley
Clarence E. Keefer
P. W. Maetzel
William M. Piatt
Thorndike Saville
Darwin W. Townsend
Abel Wolman

THE COMMITTEE ON STREET RAILWAY PAVEMENTS AND TRACK CONSTRUCTION

During the past few years the Committee has considered various types of low-cost track construction and repair work, used by several of the street railway companies partly for financial reasons and partly because of unsettled conditions in the industry. Many street railway systems are in receivership or trusteeship and funds for major reconstruction work have been quite limited, as they probably will be until the termination of such receiverships or trusteeships and business conditions become a little more attractive to the capital required for such permanent construction work as tracks. Attention has been called to the swing toward bus operation in cities with populations up to 200,000, but experience seems to indicate that streetcars will be in use for many years on the heavier lines in the larger cities.

During recent years considerable attention has been drawn to the use of the new streetcar designed by the Presidents Conference Committee of the American Transit Association, the outstanding step in street railway car design. Its light weight, smooth, noiseless operation, and quick acceleration and deceleration have been outstanding, and

there will probably be a marked reduction in the track requirements for such cars. In other words, lighter and cheaper types of construction may be used than were required for the older types of cars which are now passing out of the picture.

As it is expected that many of the old streetcars in use on what might be classed as "permanent lines" will be replaced in a few years by cars of the P.C.C. or other improved types, the Committee is of the opinion that the experience being gained by the street railway companies now operating about 700 of these P.C.C. cars will be quite valuable in selecting the design of new tracks to be laid, or for the rehabilitation of old tracks, for the operation of such cars, and that no changes should be made now in the present Specifications for Street Railway Pavements and Track Construction. After another year or two the Committee should collect data based on the experience of the operators of the new cars and secure their recommendations as to the types of track advisable under the anticipated business and financial conditions. At that time more complete data will also be available as to the qualities of the low-cost track construction work installed during the depression years.

The Committee, therefore, recommends that no changes in specifications be made this year and that the subject be continued next year for further study.

C. L. Hawkins, *Chairman*
E. A. Fisher
Albert H. Guillot
R. C. Harris
John L. Martin
Alfred E. Roche

THE COMMITTEE ON SPECIFICATIONS FOR BRICK PAVEMENTS

The Committee on Specifications for Brick Pavements met in Columbus, Ohio, in February, 1939, at the meeting of the National Paving Brick Association, and again in Washington, D. C., on September 25, 1939. Five members of the Committee were present in Columbus and six at Washington.

The revision of the method of laying brick on curves as recommended in last year's report has been made a part of the Standard Specifications of the Association and a corrected page covering this

revision has been sent to all holders of the general specifications. At the September meeting it was decided not to recommend any specific changes in the specifications as they exist at present as the Committee does not feel that several developments which they are watching closely are of sufficient importance or have developed far enough to justify the expense and trouble of reprinting even a portion of the specifications.

The Committee does have under preparation a set of specifications covering the relaying of old brick pavements according to the best possible practice and the installation of marker brick where permanent traffic lines are desired. A large amount of relaying done by Work Relief forces in many of the cities of the country has brought many requests to your Committee for such specifications. It is hoped to meet this need in the near future.

It should be noted that the A.S.T.M. Specifications C7-30 covering methods of testing of paving brick, to which the A.P.W.A. Specification refers, is now known as C7-38T. This substitution should be made by engineers using our specifications.

Marker brick of a contrasting color are now being used very widely and have been developed with a smooth glazed surface on top in place of the wire-cut surface in order that they may be more nearly self cleaning. Present end lug construction is not satisfactory as there is a tendency for the brick to hinge on the lugs in a horizontal plane. Lugs are being developed to eliminate this trouble and at the first convenient reprinting, the projection of side lugs which now reads not less than ⅛ inch nor more than ¼ inch should be defined as definite $3/16$ inch with $1/16$ inch tolerance either way. The modern wire-cut lug brick exposing a wire-cut surface to the traffic gives a smooth glazed surface in the joints for contact with the filler. The obvious advantages of a roughened surface to assist in bonding the filler in the joints have led to a study of the possibility of a paving brick having a wire-cut or roughened surface on all sides.

The proper sand for mastic bed and its relationship to the bitumen used is still a question and your Committee hopes soon to have more information on that subject as well as on the subject of fillers, which is being widely studied at this time. The immediate refilling of low joints as soon as they are discovered on new work, rather than permitting them to lie for some time and be filled at the contractor's convenience, is stressed by the Committee as desirable. In last year's report your attention was called to test roads which have been built

of reinforced brick of special size and shape. This work has not proved satisfactory. It is interesting to note, however, that the original piece of construction of this type, built of 4-inch brick of the standard size, seems to be satisfactory. A monolithic type of road where the brick have been vibrated into the green concrete base is showing up very well on the test piece built in Ohio and is still in its original condition. Other pieces of this type are being built and are being watched by your Committee for possible future recommendation.

It is very proper that this report should carry some mention of the death of George F. Fisk, former Commissioner of Public Works of the City of Buffalo, who for years served the predecessor of this Association as Chairman of this Committee. The members of this Committee who have worked with Mr. Fisk in the past deeply regret his loss to the profession.

Roy L. Phillips, *Chairman*
Warren L. Barr
A. Mason Harris
W. L. Hempelmann
Lyons Mussina
William C. Perkins
George F. Schlesinger
H. Lee Wilson

THE COMMITTEE ON CITY AND REGIONAL PLANNING

Exploitation of land by land subdividers has been a too frequent occurrence in the past. Much of it resulted from the lack on the part of public officials of sufficient knowledge of the essentials of a good basic pattern for land platting. Refusal to approve a plat could not be based on sound reasons since nothing better could be offered and, as a result, city planners are now occupied mostly in correcting those past mistakes which now appear only too evident.

To help public officials in judging the essentials of good land platting, certain recommendations are set forth by the Committee. (See page 66 for these recommendations, under the title "Tentative Subdivision Standards.") All of the recommendations cannot be accepted in all parts of the country, since each section has certain laws, regulations, and customs peculiar to the area, nor is it recommended that all of the recommended minimums be accepted as desirable. It has been

the thought of the Committee in its preparation of the report to recommend the minimum which would prove workable, although the minimums recommended may not be the most desirable.

Should the Committee recommend what it considers desirable, the regulations probably would be sufficiently discouraging to land developers and subdividers that their expense in subdividing land would equal the market value without inclusion of profit. Somewhere there is a middle ground, between what the public wants and what it can now afford. The Committee believes that this report covers that middle ground.

FREDRICK R. STORRER, *Chairman*
PIERRE BOUCHER
THOMAS BUCKLEY
ARTHUR W. CONSOER
TOM G. GAMMIE
A. J. HAWKINS
WALTER A. HEIMBUECHER
S. C. JACKA
W. E. SHEDDAN

VETERANS' AWARD COMMITTEE

BECAUSE the list of those eligible for the Veterans' Award is increasing faster than awards are being made—even at the rate of five a year—it has been suggested that the Committee consider certain changes in the eligibility requirements or in the number of medals to be issued each year.

As none of the suggestions made received the approval of the entire Committee, no recommendations for changes are made at this time. Eligibility is still based on at least 25 years of continuous service with one municipal body, not less than five years continuous membership in the A.P.W.A. or its predecessors, and present employment by the municipality as well as good standing in the A.P.W.A.

Recipients of the Veterans' Award at the 1939 Public Works Congress are as follows:

ALAN CORSON, Chief Engineer to Fairmont Park Commissioners, Philadelphia, Pa.

CHRISTOPHER S. FUNK, Surveyor, Bureau of Engineering, Surveys, and Zoning, Philadelphia, Pa.

H. Wallace Watson, Senior Surveyor, Bureau of Engineering, Surveys, and Zoning, Philadelphia, Pa.

Charles G. Calhoun, Assistant Superintendent of Buildings, Board of Education, Philadelphia, Pa.

William J. Galligan, Division Superintendent, Department of Streets, Chicago, Ill.

Hugh J. Fixmer, Division Engineer, Board of Local Improvements, Chicago, Ill.

B. B. Weber, City Engineer, Oil City, Pa.

John H. Neeson, Chief Engineer, Bureau of Engineering, Surveys, and Zoning, Philadelphia, Pa.

Scotland G. Highland, General Manager of Water Board, Clarksburg, W. Va.

W. Howard Dorn, First Assistant Surveyor, Bureau of Engineering, Surveys, and Zoning, Philadelphia, Pa.

P. L. Brockway, *Chairman*
A. Prescott Folwell
E. S. Rankin
C. W. S. Sammelman

Meeting of Board of Directors

Pittsburgh, Pa. *October 11, 1939*

The annual meeting of the Board of Directors of the American Public Works Association was held on Wednesday, October 11, 1939, at the William Penn Hotel in Pittsburgh, Pa. President John S. Flockhart presided and called the meeting to order at 12:45 P.M. Others present were: R. L. Phillips, F. T. Paul, H. L. Howe, E. L. Knebes, W. E. Rosengarten, W. W. Polk, Guy Brown, F. R. Storrer, Frank Herring, and Norman Hebden.

Invitations to hold the 1940 Public Works Congress at Detroit and Jacksonville were presented personally by representatives of these cities. Following this, a motion was passed instructing the executive director to acknowledge all of the invitations received.

The question of the most convenient time for calling the fall meeting of the Board of Directors was then discussed. December 2 was agreed upon as the tentative date, proper notice to be sent later.

The executive director, at the request of Jean L. Vincenz, Commissioner of Public Works of Fresno, California, brought up the suggestion that the Board of Directors give consideration to holding a regional meeting of the Association on the West Coast in the spring of 1940. This meeting would be patterned after the regular convention and would be known as the Western Public Works Congress sponsored by the American Public Works Association. Several questions were raised about possible conflicts with meetings of the Engineers' Section of the California League of Municipalities, the probable attitude of the Spelman Fund, and the possibility of holding such meetings annually or biennially. A motion was passed authorizing the President and the executive director to investigate the possibility of holding such a meeting, to negotiate with the California League of Municipalities in connection with plans for it, and to report to the Board of Directors at its next meeting.

Discussion was given the work of the Association's Committees and it was the consensus that the policy of having the committees write reports on specific topics in their respective fields for publication in the Yearbook should be extended. President Flockhart requested the Board members to advise him, where possible, on the selection of committee members.

The annual report of the Treasurer was presented by F. T. Paul. The Board of Directors acted as an auditing committee and the report was accepted.

It was moved and seconded that the Treasurer and the executive director be authorized to investigate and determine how much of the Special Fund of the Association can be invested, rather than remain as cash in the bank, and that that amount be so invested. The motion was passed.

The meeting adjourned at 2:00 P.M.

Meeting of the Board of Directors

Chicago, Ill. *December 2, 1939*

THE Board of Directors of the American Public Works Association met on Saturday, December 2, 1939, at Association headquarters in Chicago. President Flockhart presided and called the

meeting to order at 9:55 A.M. Those present were: George Byrum, H. L. Howe, W. E. Rosengarten, R. L. Phillips, E. L. Knebes, W. J. Galligan, F. T. Paul, W. W. Polk, Albert Learned, F. R. Storrer, Frank Herring and Norman Hebden.

The minutes of the Board of Directors' meeting held in Pittsburgh on Wednesday, October 11, 1939, were read and approved.

The executive director, using the Association's monthly financial statement as a basis, made a financial report of the Pittsburgh convention. The report was approved as given.

On the subject of the proposed Western Public Works Congress, President Flockhart and the executive director, as instructed by the Board at its last meeting, reported on the exploratory work which had been done in connection with the possibilities of holding a regional meeting on the west coast in the spring of 1940. It was reported that matters relative to this meeting had been cleared with the secretaries of the leagues of municipalities in California and Utah and with J. L. Vincenz, Commissioner of Public Works of Fresno, all of whom endorsed such a meeting and offered their full cooperation. A motion was passed approving the progress made thus far, and authorizing the president and executive director to carry the negotiations through and to stage the meeting in cooperation with the California officials.

The executive director reported on a number of invitations from various cities regarding the 1940 Public Works Congress, and President Flockhart presented an analysis of the convention questionnaire. Following a thorough discussion of the merits of the various cities which had extended invitations, the Board voted that the convention be held in Detroit. The dates for the meeting were left to the decision of the local committee but a preference was expressed for October 7, 8, and 9, or during the preceding week in case of a conflict.

The executive director presented a proposed budget for the year 1940 which was approved by the Board as drafted.

The question of Association representation on the Highway Research Board was next discussed. Under the newly revised by-laws of that organization, the A.P.W.A. is subject to the payment of dues if membership is to be retained. The directors voted to continue our representation and approved the payment of dues in the amount of $5 annually. President Flockhart then appointed Roy L. Phillips as the Association's representative on the Highway Research Board.

The meeting adjourned at 4:30 P.M.

Constitution of the American Public Works Association

I. Name

The name of the Association shall be "American Public Works Association," and its principal place of business shall be at Chicago, Illinois.

II. Purposes

The purposes of the Association shall be the advancement of the theory and practice of the design, construction, maintenance, administration, and operation of public works facilities and services; the dissemination of information and experience upon and the promotion of improved practices in public works administration; the encouragement of the adherence by public works officials to a high professional standard; and the professional and social improvement of its members.

The Association is not organized for profit, and no part of the earnings shall inure to the benefit of any member or officer, except as compensation for services rendered or for necessary expenses actually incurred.

III. Members

a. *Active*—Any person holding an elective or appointive position on a public body engaged in the field of public works, or being an officer, executive, staff member or consultant to, or a member of the staff of a consultant to, such a body, shall be eligible for Active membership in the Association.

b. *Associate*—Any person having special knowledge, experience or interest in any phase of public works activity shall be eligible for Associate membership.

c. *Senior*—Any member who shall have paid dues continuously for a period of thirty years in the Association and/or the American Society of Municipal Engineers and/or the International Association of Public Works Officials, or who at the time this constitution becomes effective is enrolled as a Senior member of the American Society of Municipal Engineers or as a Life member of the International Association of Public Works Officials, shall be eligible for Senior membership if he so elects and thereafter shall not be required to pay Association dues.

d. *Honorary*—At the recommendation of the Board of Directors

and a two-thirds vote of members present at an annual conference, persons may be elected Honorary members of the Association. Those enrolled as Honorary members in the International Association of Public Works Officials at the time this constitution becomes effective shall be continued as Honorary members of this Association.

Only Active and/or Senior members shall be entitled to hold office.

An Active member who retires from official position shall, unless otherwise ordered by the Board of Directors, be retained in his active status.

IV. Board of Directors and Executive Committee

The governing body of the Association shall be the Board of Directors, consisting of:

a. The President, First Vice-President, Second Vice-President, and Treasurer of the Association;

b. The Chairman of the Administration Division;

c. The Chairman of the Maintenance and Operation Division;

d. The Chairman of the Design and Construction Division;

e. Four Active or Senior members of the Association at-large elected at the 1937 annual meeting for terms of one, two, three and four years respectively, whose successors shall be elected for a term of four years;

f. The last living Past-President of the Association;

g. Four members of the American Society of Municipal Engineers elected by the Board of Directors of that organization at the 1936 Public Works Congress to serve from January 1, 1937, until the 1937 annual meeting of the Association;

h. Four members of the International Association of Public Works Officials elected by the Board of Governors of that organization at the 1936 Public Works Congress to serve from January 1, 1937, until the 1937 annual meeting of the Association.

The Board of Directors shall be responsible to the membership for the management of the affairs of the Association, and for the promotion of the Association's purposes. It shall have the power of enacting, by a majority vote, such by-laws as are necessary for the government of the Association.

An Executive Committee, consisting of the last living Past-President, the President, the First Vice-President, the Second Vice-President, and the Treasurer of the Association, shall have the power to exercise all the functions of the Board of Directors between annual meetings and when the Board is not in session.

In the event of a vacancy upon the Board of Directors, the remaining members of the Board shall have power to elect an Active or Senior member to fill the vacancy, to serve until the next annual meeting of members.

V. Officers

The officers of the Association shall be a President, a First Vice-President, a Second Vice-President, and a Treasurer, who shall be Active and/or Senior members elected by letter ballot of the members of the International Association of Public Works Officials and the American Society of Municipal Engineers to serve from January 1, 1937, until the 1937 annual meeting of the Association, and whose successors shall be Active and/or Senior members elected by the members of the Association at the annual meeting for a term of one year.

The Board of Directors shall select an Executive Director and such employees as they may deem proper, to serve at their pleasure, and shall fix their compensation.

In the event of a vacancy occurring in the office of President, the unexpired term shall be filled by the First Vice-President, to be succeeded by the Second Vice-President. In the event of a vacancy occurring in the office of Treasurer, the Board of Directors shall select an Active or Senior member to fill the unexpired term.

VI. Duties of Officers

a. The President shall act as Chairman of the Board of Directors and of the Executive Committee, and shall preside at meetings of the members, except as otherwise ordered by the Board. He shall appoint such standing or special committees as he shall consider necessary or as instructed by the Board of Directors, and shall be, ex-officio, a member of such committees. He shall be responsible to the Board of Directors for the functioning of these committees. He shall sign on behalf of the Association all deeds, contracts and other formal instruments, and shall perform such other duties as may from time to time be assigned to him by the Board of Directors.

b. The Vice-Presidents shall, during the absence of the President or his inability to act, have and exercise all his powers and duties, and shall also perform such other duties as may from time to time be assigned to them by the Board of Directors.

c. The Treasurer shall be the chief financial agent of the Association, and shall exercise authority in all financial matters in accordance

with such by-laws and resolutions as may be adopted by the Board of Directors. The Executive Director shall furnish the Treasurer with such financial statements as he may require. The Treasurer shall have the custody of all funds and securities of the Association, including all bonds, stocks, deeds, and other documents, and to this end he may determine the manner of depositing and safe-keeping of the funds and securities of the Association and the system of financial records. The Board of Directors shall fix the amount of the bond to be furnished by the Treasurer, the cost of such bond to be borne by the Association.

d. The Executive Director shall be in charge of the general management of the affairs of the Association subject to this constitution and such regulations as may be adopted by the Board of Directors. He shall collect all fees and other moneys owing to the Association and shall deposit them to the credit of the Association; he shall annually prepare a budget for the Association and upon its approval by the Board of Directors shall have authority to expend the sums appropriated; he shall keep a complete record of all his receipts and expenditures, which shall annually be audited by a firm of certified public accountants and the report submitted to the Board of Directors; he shall give bond in such form and amount as may be determined by the Board of Directors, the cost of such bond to be borne by the Association. He may appoint and discharge any employees or subordinates, and shall fix their compensation within such limits as may be provided by the budget, and may make agreements on behalf of the Association in performing the duties entrusted to him. He shall act as Secretary of the Association, shall conduct its correspondence, shall give notice of and keep minutes of all meetings, and shall have custody of the records of the Association and of the corporate seal, and shall attest all instruments. He shall perform such other duties as may be assigned to him by the President and the Board of Directors.

VII. Meetings

An annual meeting of the members of the Association shall be held at a time and place to be determined by the Board of Directors. Special meetings shall be held on the call of the President or the Board of Directors, or upon the request in writing of any one hundred and twenty-five Active and/or Senior members. Such special meetings shall be held within thirty days of the receipt of request. The Board of Directors shall have its annual meeting immediately following the an-

nual meeting of the members. Special meetings of the Board of Directors or of the Executive Committee shall be held on the call of the President or on the request in writing of any three members of the Board or Committee.

At least five days' notice of the time, place, and purpose of all meetings shall be given to all persons entitled to notice thereof. Such notice may be given by mail or telegram to the last known address of the person, or personally.

VIII. Quorum

A majority of the Board of Directors shall constitute a quorum thereof. A quorum of the Executive Committee shall be three members. Twenty members shall constitute a quorum to do business at a meeting of members.

IX. Dues

The annual dues for Active and Associate members shall be as determined from time to time by the Board of Directors, subject to the approval of the membership. Non-payment of dues for two years shall be treated as equivalent to resignation, unless otherwise provided by the Board of Directors, and the name of the member shall be removed from the rolls of the Association, provided at least four weeks' notice is given, during which time he may discharge his obligations and have his membership continued.

X. Nominations

A Nominating Committee, composed of two members of the International Association of Public Works Officials selected by the Board of Governors of that organization at the 1936 Public Works Congress and two members of the American Society of Municipal Engineers selected by the Board of Directors of that organization at the 1936 Public Works Congress, shall propose the names of candidates for President, First Vice-President, Second Vice-President, and Treasurer to serve from January 1, 1937, until the 1937 annual meeting.

The President, with the approval of the Board of Directors, shall thereafter appoint each year a Nominating Committee of five Active and/or Senior members, which shall propose the names of candidates for all officers and directors-at-large to be voted upon at the annual meeting. Additional nominations may be made from the floor at the annual meeting by any Active member.

XI. Divisions

There shall be three Divisions to provide for the specialized interests of the members of the Association: The Administration Division, the Design and Construction Division, and the Maintenance and Operation Division. A member of the Association may register in any one or more of the Divisions. Each Division shall be presided over by a Chairman, who shall be elected at the annual meeting by the members registered in that Division. The same person shall not serve as Chairman continuously of the same Division in excess of two years.

The three Divisions shall be managed in conformity with the constitution of the Association and the rules established by the Board of Directors.

XII. Chapters

The Association shall encourage and recognize the establishment of regional, state and local chapters of its members, the purposes of which shall be the furtherance of the objectives of the Association in the region, state or locality. Applications for the establishment of a chapter, together with a copy of the proposed chapter by-laws and a list of those who have agreed to become members of the chapter, shall be submitted to the Board of Directors for approval. Upon notice of approval given by the Board, the chapter shall be considered established.

All chapters shall be managed in conformity with the constitution of the Association and the rules established by the Board of Directors.

XIII. Seal

The Association shall have a seal which shall bear the legend "American Public Works Association," and the year of incorporation.

XIV. Waiver of Notice and Action Without Meeting

Any person entitled to vote at any meeting of members, or of the Board of Directors, or of the Executive Committee, may waive notice of the time, place, and purpose of such meeting either before or after the date of such meeting, and any action taken or resolution adopted thereat shall, upon such waiver, be as valid as though notice had been given.

Any action or resolution which might be taken or adopted at any meeting of the Board of Directors, Executive Committee, or mem-

bers, shall be valid if written memorandum of such action or resolution is duly served upon all persons entitled to vote thereon in the manner prescribed for notice of a meeting, and if such action or resolution is approved in writing by a majority of the persons entitled to vote thereon.

XV. Amendments

Proposed amendments to this constitution must be submitted to the Board of Directors in writing, signed by not less than twenty-five Active and/or Senior members. If the proposed amendment is approved by the Board of Directors, it shall be submitted to the membership for letter ballot. An affirmative vote of two-thirds of the qualified votes cast shall be necessary for the adoption of a proposed amendment.

Association Committees*

COMMITTEE ON AIRPORTS AND LANDING FIELDS

ROBERT S. HEDTLER, *Chairman,* Consulting Engineer for Aeronautics, 1420 21st St., N. W., Washington, D. C.

PERRY A. FELLOWS, Assistant Chief Engineer, Work Projects Administration, 1937 38th St., Washington, D. C.

W. W. HORNER, Consulting Engineer, and Professor of Municipal and Sanitary Engineering, Washington University, 1312 International Office Bldg., St. Louis, Mo.

CORNELIUS W. PHILLIPS, Superintendent, Department of Streets and Engineering, 36 Court St., Springfield, Mass.

W. H. ROBERTS, Commissioner of Public Works, 54 Court St., Rochester, N. Y.

HOWARD M. SHAFER, Airport Manager, Department of Commerce, 34 Court St., Rochester, N. Y.

COMMITTEE ON CITY AND REGIONAL PLANNING

FREDRICK R. STORRER, *Chairman,* City Engineer, Municipal Bldg., Dearborn, Mich.

THOMAS BUCKLEY, Chief Engineer and Surveyor, Bureau of Engineering, Surveys and Zoning, 1102 City Hall Annex, Philadelphia, Pa.

ARTHUR W. CONSOER, General Manager, Consoer, Townsend & Quinlan, 211 W. Wacker Dr., Chicago, Ill.

A. J. HAWKINS, Civil Engineer, 4020 Ninth Court, South, Birmingham, Ala.

WALTER A. HEIMBUECHER, City Engineer, City Hall, University City, Mo.

HARVEY W. HINCKS, City Engineer and Superintendent of Streets, 211 City Hall, Pasadena, Calif.

S. C. JACKA, City Engineer, City Hall, Lansing, Mich.

JOSEPH P. SCHWADA, City Engineer, City Hall, Milwaukee, Wis.

COMMITTEE ON FIELD ENGINEERING

WALTER STARKWEATHER, *Chairman,* District Civil Engineer, U.S. Coast Guard, Seattle District, 400 Insurance Bldg., Seattle, Wash.

LLOYD ALDRICH, City Engineer, 600 City Hall, Los Angeles, Calif.

HERBERT M. DIBERT, Secretary and Treasurer, W. & L. E. Gurley, 514 Fulton St., Troy, N. Y.

ROBERT H. RANDALL, Consultant, National Resources Planning Board, North Interior Bldg., Washington, D. C.

FREDERICK THOMAS THORPE, JR., Surveyor and Regulator, 1129 Sanger St., Frankford, Philadelphia, Pa.

B. B. WEBER, City Engineer, City Bldg., Oil City, Pa.

* As appointed in January, 1940.

COMMITTEE ON PUBLIC LIGHTING

Sanford C. Lovett, *Chairman,* Superintendent of Light, Bureau of Engineering, 445 City-County Bldg., Pittsburgh, Pa.
W. T. Blackwell, General Lighting Representative, Public Service Electric & Gas Co., 80 Park Place, Newark, N. J.
Ellsworth Francisco, Engineer in Charge, Bureau of Lighting, City Hall, Newark, N. J.
John F. Gallagher, Accident Analysis Engineer, Division of Traffic Engineering, Department of Public Safety, 790 City Hall, Philadelphia, Pa.
Anton Pav, Commissioner of Public Works, 6700 W. 26th St., Berwyn, Ill.
Kirk M. Reid, Illuminating Engineer, Nela Park Engineering Dept., General Electric Co., Cleveland, Ohio.
Samuel H. Strickland, Director of Public Works, High Point, N. C.
Peter J. Stupka, Traffic Engineer, Div. of Professional Projects, WPA, Auditorium, 19th & E Sts., Washington, D. C.
Arthur L. Wichner, Superintendent of Public Works, City Hall, West Allis, Wis.
Stuart R. Williams, Manager, Street Lighting Department, Holophane Co., Newark, Ohio
L. A. S. Wood, Chief Lighting Engineer, Westinghouse Electric & Mfg. Co., 1216 W. 58th St., Cleveland, Ohio

COMMITTEE ON PUBLIC UTILITIES

T. Fred Older, *Chairman,* Manager of Public Utilities, 125 W. Michigan Ave., Ypsilanti, Mich.
Fred A. Earhart, Commissioner of Public Utilities, City Hall, New Orleans, La.
D. L. Erickson, Director, Parks, Public Property and Improvements, City Hall, Lincoln, Neb.
Harry Goodridge, City Engineer and Superintendent of Streets, City Hall, Berkeley, Calif.
Edgar B. Hess, Civil Engineer, 183 Plum St., Chillicothe, Ohio
Albert P. Learned, Engineer, Black & Veatch, 4706 Broadway, Kansas City, Mo.
G. J. Requardt, Consulting Engineer, Whitman, Requardt & Smith, Biddle St. at Charles, Baltimore, Md.
Alfred E. Roche, Division Engineer, Work Projects Administration, 74 Chapel Street, Albany, N. Y.
Frank M. Roessing, Director, Department of Public Works, 417 City-County Building, Pittsburgh, Pa.
Walter A. Shaw, Consulting Engineer, 30 N. LaSalle St., Chicago, Ill.

COMMITTEE ON REFUSE COLLECTION AND DISPOSAL

Stuart M. Weaver, *Chairman,* Executive Assistant to Director of Pub-

lic Works, and Superintendent of Water Bureau, City Hall, Montclair, N. J.

WILLIAM J. GALLIGAN, Division Superintendent, Bureau of Streets, 2840 S. Calumet Ave., Chicago, Ill.

DAVID W. GODAT, Maintenance Engineer, Department of Public Works, 18 City Hall, New Orleans, La.

JOHN V. LEWIS, Director of Maintenance and Operation, Department of Public Works, 54 Court St., Rochester, N. Y.

CARL SCHNEIDER, Consulting Engineer, 7711 Plum St., New Orleans, La.

RALPH C. TAYLOR, Superintendent, Waste Collection Division, 350 City Hall, Cincinnati, Ohio

JEAN L. VINCENZ, Commissioner Public Works and City Engineer, City Hall, Fresno, Calif.

COMMITTEE ON SEWERAGE AND SEWAGE DISPOSAL

ALBERT P. LEARNED, *Chairman,* Engineer, Black and Veatch, 4706 Broadway, Kansas City, Mo.

CARL B. CARPENTER, Assistant Engineer, Charles H. Hurd Co., 5618 Calumet Ave., Hammond, Ind.

MORRIS M. COHN, Sanitary Engineer, City Hall, Schenectady, N. Y.

WILLIAM C. EMIGH, City Engineer, City Hall, Coatesville, Pa.

JAMES L. FEREBEE, Chief Engineer and Manager City Sewerage Commission, Box 2079, Milwaukee, Wis.

JOHN B. HAWLEY, Consulting Civil Engineer, 407 Capps Bldg., Fort Worth, Tex.

CLARENCE E. KEEFER, Associate Engineer, 1918 Mt. Royal Terrace, Baltimore, Md.

P. W. MAETZEL, City Engineer, City Hall, Columbus, Ohio

WILLIAM M. PIATT, Consulting Engineer, 111 Corcoran Street Bldg., Durham, N. C.

THORNDIKE SAVILLE, Dean and Professor of Hydraulic Sanitary Engineering, New York University, Box 65, University Heights, New York, N. Y.

DARWIN W. TOWNSEND, Consulting Engineer, Consoer, Townsend and Quinlan, 839 N. Marshall St., Milwaukee, Wis.

ABEL WOLMAN, Chairman, National Water Resources Committee, Professor of Sanitary Engineering, Johns Hopkins University, Homewood, Baltimore, Md.

COMMITTEE ON STREET CLEANING

WILLIAM ALBERT XANTEN, *Chairman,* Supervisor, City Refuse Division, Engineering Department, District Bldg., Washington, D. C.

LEO P. GALLEN, General Superintendent, Bureau of Highways and Street Cleaning, 924 City Hall Annex, Philadelphia, Pa.

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H. W. Johnston, City Engineer, City Hall, Halifax, Nova Scotia.

George H. Sanborn, Deputy Commissioner, Public Works, 315 DeForest Rd., Syracuse, N. Y.

Charles J. Sheets, Street Commissioner, City Hall, Cleveland, Ohio

G. E. Taylor, Deputy Street Commissioner, 90 Albert St., Toronto, Ontario.

N. M. Ulsch, Assistant Superintendent, Street Cleaning Department, 5th and Cleveland St., Jacksonville, Fla.

Wilbur H. Winship, Street Commissioner, Room 5, City Hall, Indianapolis, Ind.

COMMITTEE ON STREET PAVING

George H. Sandenburgh, *Chairman,* City Engineer, City Hall, Ann Arbor, Mich.

Arvid Anton Anderson, Manager, Highways and Municipal Bureau, Portland Cement Assn., 33 W. Grand Ave., Chicago, Ill.

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George Byrum, Jr., Street Commissioner, 401 City Hall, Birmingham, Ala.

Andrew Eschenfelder, Borough Engineer, Municipal Bldg., Glen Ridge, N. J.

Walter N. Frickstad, City Engineer, 803 City Hall, Oakland, Calif.

Prevost Hubbard, Chemical Engineer, The Asphalt Institute, 801 Second Ave., New York, N. Y.

E. L. Knebes, Assistant City Engineer, 407 City Hall, Milwaukee, Wis.

Hugh W. Skidmore, Director, Chicago Testing Laboratory, Inc., 536 Lake Shore Dr., Chicago, Ill.

Nathan L. Smith, Consulting Engineer, Maryland State Roads Commission, Federal Reserve Bank Bldg., Baltimore, Md.

COMMITTEE ON TRAFFIC CONTROL

Burton W. Marsh, *Chairman,* Director, Safety and Traffic Engineering Department, American Automobile Association, Pennsylvania Ave. at 17th St., Washington, D. C.

George W. Barton, Director, Traffic and Safety Engineering, Chicago Motor Club, 66 E. South Water St., Chicago, Ill.

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Edwin F. Koester, Survey and Traffic Engineer, 414 W. 22nd St., Wilmington, Del.

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Theodore M. Matson, Research Associate, Bureau for Street Traffic Research, 315 Strathcona Hall, Yale University, New Haven, Conn.

D. Grant Mickle, Traffic and Safety Engineer, Michigan State Highway Department, Lansing, Mich.

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COMMITTEE ON WATER WORKS

Laurence G. Lenhardt, *Chairman,* Superintendent and General Manager, Board of Water Commissioners, 506 Water Board Bldg., Detroit, Mich.

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Frederick Ohrt, Manager and Chief Engineer, Board of Water Supply, P. O. Box 3347, Honolulu, T. H.

Walter A. Peirce, Manager, Water Department, City Hall, Racine, Wis.

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George N. Schoonmaker, City Manager, City Hall, Toledo, Ohio

Leon A. Smith, Superintendent, Water Works, City Hall, Madison, Wis.

William Sydow, Director of Public Service, Miami, Fla.

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SPECIFICATIONS COMMITTEE ON BITUMINOUS PAVEMENTS

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SPECIFICATIONS COMMITTEE ON BRICK PAVEMENTS

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Lyons Mussina, City Engineer, City Hall, Williamsport, Pa.

William C. Perkins, Chief Engineer, Eastern Paving Brick Assn., Langhorne, Pa.

SPECIFICATIONS COMMITTEE ON CEMENT CONCRETE PAVEMENTS

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Harvey Hincks, City Engineer and Superintendent of Streets, 211 City Hall, Pasadena, Calif.

Irving Hochstadter, President and Technical Director, Stillman & Van Siclen, Inc., 254 W. 31st St., New York, N. Y.

Elmer W. Hopkins, City Engineer, City Hall, Salina, Kan.

Edward M. Hunt, Commissioner of Public Works, City Engineer, City Hall, Portland, Me.

Oliver L. King, Township Engineer, Township Building, Abington, Pa.

J. A. Loughlin, City Engineer, City Hall, Wilmington, N. C.

Monroe L. Patzig, Testing Engineer, Patzig Testing Laboratories, 2215 Ingersoll Ave., Des Moines, Iowa

W. E. Sheddan, City Engineer, City Engineers' Bldg., Jacksonville, Fla.

Stanton Walker, Director of Engineering, National Sand and Gravel Assn., Munsey Bldg., Washington, D. C.

SPECIFICATIONS COMMITTEE ON SEWERS

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Harold L. Andrus, City Engineer and Director of Public Works, City Hall, Kalamazoo, Mich.

SAMUEL C. CANNON, Superintendent of Public Works, Municipal Bldg., Middletown, Conn.
H. WALTER HUGHES, Supervisor, Section Tests and Materials, 34 Court St., Rochester, N. Y.
MERVIN H. KOHLER, Assistant Engineer, Bureau of Engineering, Surveys and Zoning, City Hall Annex, Philadelphia, Pa.
WALTER E. KROENING, Director of Service and Village Engineer, Administration Building, Greendale, Wis.
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Abbot, Munro L. (1931) Surveyor & Regulator, 6th District, Bureau of Eng., Surveys & Zoning, 931 W. Lehigh Ave., Philadelphia, Pa.

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Ahrens, Herman F. (Jr.) (Assoc.-1921) Treas., Lock Joint Pipe Co., P. O. Box 21, Ampere, N. J.

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Aldridge, William (1912) Asst. City Engr., 333 McGee St., Winnipeg, Manitoba, Can.

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Aloff, Abraham M. (1933) Civil Service Examiner, Room 152, State House, Boston, Mass.

Anderson, A. M. (Life-1920) Vice-Pres. & Treas., Elgin Corp., 100 N. LaSalle St., Chicago, Ill.

Anderson, Arvid Anton (1936) Mgr., Highways & Municipal Bureau, Portland Cement Assn., 33 W. Grand Ave., Chicago, Ill.

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Anderson, Robert L. (1935) Supt. of Public Works, Village Hall, Winnetka, Ill.

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Baker, Jacob (1935) Pres., United Federal Workers of America, 532 17th St., Washington, D. C.

Baldry, William Earnest (1918) City Engr., 1206 W. 13th St., Topeka, Kan.

Ballantyne, George H. (1928) Comr. of Public Works, 208 City Hall, Syracuse, N. Y.

Ballo, Alfred (Dr.) (Honorary-1935) Director, Dept. of Public Cleansing, Budapest, Hungary.

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Bartow, Edward (1920) Prof., Head of Dept. of Chemistry & Chemical Eng., State University of Iowa, Iowa City, Iowa.

Baugh, E. A. Director of Public Works, City Hall, Dallas, Tex.

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Biser, D. Benton (1930) Director & Secy., Com. on Governmental Efficiency & Economy, Inc., Mercantile Trust Bldg., Baltimore, Md.

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Bowers, Gamble M. (1939) Director of Public Works, 219 Governor St., Richmond, Va.
Bradley, Harold D. (1926) Street Comr., 90 Albert St., Toronto 2, Ontario, Can.
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Gascoigne, George B. (1922) Cons. Engr., 1140 Leader Bldg., Cleveland, Ohio, & 1522 Woolworth Bldg., New York, N. Y.

Gates, Justin F. (1938) Comr. of Public Works, 26 Commonwealth Ave., Middletown, N. Y.

Gayton, Loran D. (1938) City Engr., City Hall, Chicago, Ill.

Gearen, M. C. (1927) Bridge Engr., Dept. of Public Works, 300 Cliff Ave., Racine, Wis.

George, Henry H. (III) (1938) Asst. Engr. in Charge of Services, City Hall, Norfolk, Va.

Gettelman, Fred, Co. (Assoc.-1928) High Speed Snow Plows, 4400 State St., Milwaukee, Wis.

Gibbs, Joseph C. (1931) Senior Surveyor, Bureau of Eng., Surveys & Zoning, 7236 Elmwood Ave., Philadelphia, Pa.

Giesey, Jesse K. (1922) Resident Engr., Greeley & Hansen, 31 Lowell Rd., Kenmore, N. Y.

Giles, J. A. (1939) City Engr., City Hall, Binghamton, N. Y.

Gill, J. Francis (1928) Comr. of Public Works, City Hall, Oswego, N. Y.

Gill, Joseph E. (1932) Construction Engr., Bureau of Water, Penn Athletic Club, 18th & Locust Sts., Philadelphia, Pa.
Godat, David W. (1936) Maintenance Engr., Dept. of Public Works, 18 City Hall, New Orleans, La.
Good, Raymond C. (1932) Surveyor, 7440 N. 21st St., Philadelphia, Pa.
Goodell, Paul Homer (Assoc.-1933) Radiant Heat Div., C. M. Hall Lamp Co. 1035 Hancock Ave., E., Detroit, Mich.
Goodridge, Harry (1929) City Engr. & Supt. of Streets, City Hall, Berkeley, Calif.
Goodspeed, Roy F. (1938) City Engr. & City Assessor, 21203 Woodward Ave., Ferndale, Mich.
Gordon, Murray L. (1937) Town Engr., Box 95, Truro, Nova Scotia, Can.
Graddy, J. M. (1935) Supt. of Public Works, 1401 10th Ave., Columbus, Ga.
Graham, Ralph C., Supt. Construction & Public Works, City Hall, Davenport, Iowa.
Grasser, Frank G. (1930) Supt. of Streets, City Hall, Kenosha, Wis.
Greeley, Samuel A. (1919) Greeley & Hansen, Cons. Engrs., Suite 1700, 6 N. Michigan Ave., Chicago, Ill.
Greenawalt Engineering Company, Inc. (Assoc.-1933) 405 Lexington Ave., New York, N. Y.
Greene, Clark M. (1937) Comr. Public Works & Eng., 13615 Michigan Ave., Dearborn, Mich.
Greenlee, B. I. (1935) Comr. of Public Works, City Hall, LaGrange, Ill.
Grimes, Kenneth D. (1938) Mgr. Public Affairs Div., Peoria Assn. of Commerce, Peoria, Ill.
Guillot, Albert H. (1932) Roadway Engr., New Orleans Public Service, Inc., 1423 Adams St., New Orleans, La.
Gulick, Luther (1926) Director, Institute of Public Administration, 261 Broadway, New York, N. Y.
Gundlach, George C. (1931) Drainage Engr., Soil Conservation Service, 125 W. Elm St., Lima, Ohio.
Guyn, J. White (1935) Construction Engr., 375 Aylesford St., Lexington, Ky.
Haddow, A. W. (1928) City Engr., City Hall, Edmonton, Alberta, Can.
Hadley, Henry (1937) City Engr., City Hall, Verdun, Quebec, Can.
Hafner, Ralph (1929) Designing Traffic Draftsman, Bureau of Police, City Hall, Philadelphia, Pa.
Halpin, Eugene (Jr.) (1935) Comr. of Public Works, City Hall, White Plains, N. Y.
Hamilton, Lewis C. (1932) Asst. Engr., Dept. of Public Affairs, 55 Lincoln Ave., Newark, N. J.
Hancock, Edwin (1926) Cons. Municipal Engr., 1509 Jackson Blvd., Chicago, Ill.
Hannum, Erwin C. (1938) 1631 S St., N. W., Washington, D. C.
Hansell, William A. (Life-1916) Asst. Chief of Construction & Engr. of Sewers, 737 Woodland Ave., S. E., Atlanta, Ga.

Hansen, Paul (1913) Greeley & Hansen, Suite 1700, 6 N. Michigan Ave., Chicago, Ill.

Harral, Henry D. (1938) Planning Engr., Lower Merion Twp., 21 Chatham Road, Ardmore, Pa.

Harris, A. Mason (1929) Chief, Bureau of Streets, 217 Governor St., Richmond, Va.

Harris, R. C. (1914) Comr. of Works, City Hall, Toronto, Ontario, Can.

Hartley, G. Russell (1936) City Engr., Municipal Bldg., Englewood, N. J.

Hartley, Robert W. (1940) Technical Secy., Public Works Committee, Natl. Resources Planning Bd., N. Interior Bldg., Washington, D. C.

Hartmann, Frank J. (1937) Director of Public Works, City Hall, Camden, N. J.

Hathaway, A. S. (1936) Asst. Prof., Northwestern Technological Institute, 1930 Sherman Ave., Evanston, Ill.

Haulard, M. V. (1929) Supt., Municipal Repair Plant, 4154 Therville St., New Orleans, La.

Hawkins, A. J. (1922) Civil Engr., 4020 9th Court So., Birmingham, Ala.

Hawkins, C. L. (1920) Supt., Maintenance of Way, St. Louis Public Service Co., 3869 Park Ave., St. Louis, Mo.

Hawley, John B. (1912) Cons. Civil Engr., 407 Capps Bldg., Fort Worth, Tex.

Hayden, Jackson B. (1939) Town Engr., Municipal Bldg., Montclair, N. J.

Haydock, Winters (1927) 1372 Vancouver Ave., Burlingame, Calif.

Hayes, George P. (Jr.) (1931) Office Engr., Pennsylvania Railroad Co., Berwyn, Pa.

Heald, Henry Townley (1935) Pres., Armour Institute of Technology, 3300 Federal St., Chicago, Ill.

Hebden, Norman (1936) Asst. Director, Am. Public Works Assn., 1313 E. 60th St., Chicago, Ill.

Hedtler, Robert S. (1931) Cons. Engr. for Aeronautics, 1420 21st, N. W., Washington, D. C.

Heide, Joseph (Jr.) (Assoc.-1937) 886 Summit Ave., Jersey City, N. J.

Heil, Julius P. (Assoc.-1928) Pres., The Heil Co., Milwaukee, Wis.

Heimbuecher, Walter A. (1931) City Engr., City Hall, University City, Mo.

Helber, William G. (1939) Supt., Bur. of Refuse Disposal, Route 14, Box 525, Portland, Ore.

Helm, J. S. (Assoc.-1913) Mgr., Asphalt Sales Dept., Standard Oil Co. of N. J., 26 Broadway, New York, N. Y.

Hempelmann, W. L. (Assoc.-1911) Engr., Asphalt Sales Dept., The Texas Co., 332 S. Michigan Ave., Chicago, Ill.

Henry, Jay E. (1939) City Engr. & Director of Public Utilities, City-County Bldg., Wheeling, W. Va.

Herring, Frank W. (1935) Executive Director, Am. Public Works Assn., 1313 E. 60th St., Chicago, Ill.

Herzog, Lester W. (1924) Upstate New York Administrator, WPA, Old Post Office Bldg., Albany, N. Y.

Hess, Edgar B. (1936) Civil Engr., 183 Plum St., Chillicothe, Ohio.

Hesselbacher, George E. (1934) Cheltenham Township Engr., 8200 Fairview Rd., Elkins Park, Pa.

Hicklin, R. G. (1937) Mgr. Municipal Eng. Dept., Robert & Company, Inc., 706 Bona Allen Bldg., Atlanta, Ga.

Highland, Scotland G. (1921) Secy., Treas., Gen. Mgr. & Senior Engr., Water Bd., Clarksburg, W. Va.

Hincks, Harvey W. (1937) City Engr. & Supt. of Streets, 211 City Hall, Pasadena, Calif.

Hochstadter, Irving (1928) Pres. & Technical Director, Stillman & Van Siclen, Inc., & Hochstadter Laboratories, Inc., 254 W. 31st St., New York, N. Y.

Hodson, Edward T. (1938) Comr. of Public Works, 313 Municipal Bldg., New Bedford, Mass.

Hoffmann, Robert (Senior-1908) Cons. Engr., 518 City Hall, Cleveland, Ohio.

Hoots, Paul F. (1932) Asst. to Pres., New Orleans Public Service, Inc., 317 Baronne St., New Orleans, La.

Hopkins, Elmer W. (1931) City Engr., City Hall, Salina, Kan.

Horner, W. W. (Life-1915) Cons. Engr. & Prof. Municipal & Sanitary Engr., Washington University, 1312 International Office Bldg., St. Louis, Mo.

Howe, Henry L. (1926) City Engr., 52 City Hall, Rochester, N. Y.

Howland, Charles A. (1923) Staff Engr., Bureau of Municipal Research, 311 S. Juniper St., Philadelphia, Pa.

Howson, L. R. (1926) Cons. Engr., Alvord, Burdick & Howson, 20 N. Wacker Dr., Chicago, Ill.

Hubbard, Prevost (1913) Chemical Engr., The Asphalt Institute, 801 Second Ave., New York, N. Y.

Hubbell, Clarence W. (1928) Pres., Hubbell, Roth & Clark, Inc., Cons. Engrs., 2640 Buhl Bldg., Detroit, Mich.

Hughes, Charles A. (1938) Office Engr., City Hall, New Rochelle, N. Y.

Hughes, Charles W. (1920) Cons. Engr., 2147 Fifth St., Port Arthur, Tex.

Hughes, H. Walter (1936) Supervisor, Section Tests & Matls., 34 Court St., Rochester, N. Y.

Hughey, Beecher (1939) Comr. of Streets & Public Improvements, City Hall, Decatur, Ill.

Hunt, Edward M. (1935) Comr. of Public Works, City Engr., City Hall, Portland, Maine.

Hunter, John H. (II) (1937) Traffic Signal Engr., Traffic Eng. Div., Bureau of Police, 790 City Hall, Philadelphia, Pa.

Hyland, N. W. (1930) Asst. Director of Public Works, City Hall, Kansas City, Mo.

International Harvester Company (Assoc.-1932) 180 N. Michigan Ave., Chicago, Ill.

Ireland, C. B. (1938) City Engr. & St. Supt., City Hall, National City, Calif.

Ireland, C. Eugene (Assoc.-1920) Pres., Birmingham Slag Co., 2019 Sixth Ave., N., Birmingham, Ala.

Jacka, Samuel C. (1937) City Engr., City Hall, Lansing, Mich.

Jackson, M. D. (1937) City Engr., 612 Clark St., Stevens Point, Wis.

Jenkins, Frank L. (1936) City Engr., Municipal Bldg., Portland, Mich.

Jennetty, Adam (1935) Street Comr., City Hall, Perth Amboy, N. J.

Jennings, Irving C. (1929) Pres., Nash Eng. Co., South Norwalk, Conn.

Johnson, Andrew K. (1928) Engr. of Highways, Borough of Queens, New York City, 190-24 111th Rd., St. Albans, N. Y.

Johnson, Charles E. (1939) Street Comr., City Hall, Gary, Ind.

Johnston, Grant (1936) Gen. Foreman, WPA, 245 Sumac St., Wissahicken, Philadelphia, Pa.

Johnston, H. W. (1937) City Engr., City Hall, Halifax, Nova Scotia, Can.

Joseph, Ben H. (1931) Senior Surveyor, 1152 E. Brill St., Philadelphia, Pa.

Kearney, John J. (1926) Cons. Municipal Engr., 3136 Maple Ave., Berwyn, Ill.

Keating, Charles S. (1935) Cons. Engr., 400 City Hall, Syracuse, N. Y.

Keefer, Clarence E. (1922) Assoc. Engr., 1918 Mt. Royal Terrace, Baltimore, Md.

Kendall, Theodore Reed (1922) Eng. Editor, "The American City Magazine," 470 Fourth Ave., New York, N. Y.

Kennedy, G. D. (1935) Deputy Comr., in Charge of Business Administration, State Highway Dept., Lansing, Mich.

Kernan, Francis F. (1931) Office Engr., City Engineer's Office, University City, Mo.

Kershaw, William H. (Assoc.-1911) Mgr. Sales Dept., The Texas Co., 135 E. 42nd St., New York, N. Y.

Ketcham, Clarence H. (1934) Chief Supervising Sta. Engr., Dept. of Sanitation, 125 Worth St., New York, N. Y.

Killmer, Albert R. (1932) Transitman, 2828 N. Marston St., Philadelphia, Pa.

King, Oliver L. (1929) Abington Township Engr., Township Bldg., Abington, Pa.

Klebes, H. J. (1939) Director of Streets & Public Improvements, City Hall, Erie, Pa.

Kleinsteiber, John (1937) City Engr., City Bldg., Canton, Ill.

Klorer, John (1921) Cons. & Planning Engr., Sewerage & Water Bd., 526 Carondelet St., New Orleans, La.

Knapp, Kenneth J. (1936) Asst. Engr., 52 City Hall, Rochester, N. Y.

Knebes, E. L. (1926) Asst. City Engr., 407 City Hall, Milwaukee, Wis.

Koester, Edwin F. (1928) Survey & Traffic Engr., 414 W. 22nd St., Wilmington, Del.

Kohler, George F. (1929) Surveyor & Regulator, 1st Dist., 2010 Rhawn St., Philadelphia, Pa.

Kohler, H. R. (1937) Asst. Engr., 52 City Hall, Rochester, N. Y.
Kohler, Mervin H. (1937) Asst. Engr., Bureau of Eng., Surveys & Zoning, 1232 City Hall Annex, Philadelphia, Pa.
Kohnke, R. B. (1930) Asst. State Engr., Bd. of State Engrs., 207 New Orleans Court Bldg., New Orleans, La.
Kopf, Herbert P. (1937) Asst. Engr., 54 Court St., Rochester, N. Y.
Kortekamp, Harry G. (1938) Supervisor, Waste Collection Div., Dept. of Public Works, City Hall, Cincinnati, Ohio.
Kramer, Raymond M. (1931) Surveyor, 1713 Dyre St., Frankford, Philadelphia, Pa.
Kriege, H. F. (1930) Technical Director, France Stone Co., 1219 W. Bancroft St., Toledo, Ohio.
Kroening, Walter E. (1939) Director of Service & Village Engr., Administration Bldg., Greendale, Wis.
Krohn, Herman (1931) Asst. City Planning Engr., 1103 City Hall Annex, Philadelphia, Pa.
Krohne, Arthur D. (1937) Asst. Civil Engr., U. S. Coast Guard, 51 Carroll Ave., Takoma Park, Washington, D. C.
Krug, Richard E. (Assoc.-1939) Librarian, Municipal Reference Library, City Hall, Milwaukee, Wis.
Krupicka, Anton J. (1937) Comr., Dept. of Public Works, 5520 W. Cermak Rd., Cicero, Ill.
Kuhn, Robert J. (1932) Cons. Engr., Electrolysis & Corrosion, 1644 Canal Bank Bldg., New Orleans, La.
Laboon, J. F. (1930) Director, County Dept. of Works, Allegheny County, 501 County Office Bldg., Pittsburgh, Pa.
La Guardia, F. H. (Honorary-1938) Mayor, City Hall, New York, N. Y.
Lamson, B. F. (1925) City Engr., City Hall, St. Catharines, Ontario, Can.
Lanahan, Frank J. (Assoc.-1931) Pres., Fort Pitt Malleable Iron Co., P. O. Box 505, Pittsburgh, Pa.
Laphen, Morris (1931) District Supt., Bureau of Streets, 2840 S. Calumet Ave., Chicago, Ill.
Law, Leroy M. (1928) 455 Paul Brown Bldg., St. Louis, Mo.
Lawler, L. D. (1937) Asst. Engr., Dept. of Eng., 33 Glasgow St., Rochester, N. Y.
Lawlor, Thomas F. (1926) Cons. Engr., 140 South Cherry St., Poughkeepsie, N. Y.
Lawrence, Richard W. (1939) Asst. Comr. of Streets, City Hall, Cleveland, Ohio.
Leake, George E. (1933) Ward Supt., Bureau of Streets, 208 S. Racine Ave., Chicago, Ill.
Learned, Albert P. (1926) Engr., Black & Veatch, 4706 Broadway, Kansas City, Mo.
Leary, Harry J. (1937) Dept. of Public Works, 903 City Hall Annex, Philadelphia, Pa.
Lee, Frank O. (1935) Director of Public Works, City Hall, St. Petersburg, Fla.

Leibowitz, David (1932) Asst. Engr., Pres., Borough of Bronx, Div. of Design, 910 Bronx County Bldg., New York, N. Y.

Lenhardt, Laurence G. (1936) Supt. & General Mgr., Bd. of Water Comrs., 506 Water Bd. Bldg., 735 Randolph St., Detroit, Mich.

Lewis, John V. (1934) Director of Maintenance & Operation, Dept. of Public Works, 54 Court St., Rochester, N. Y.

Liddle, F. W. (1938) City Engr., City Hall, Wyandotte, Mich.

Liddle, George F. (1939) City Supt. & City Engr., City Hall, Muskegon Heights, Mich.

Loewe, Arthur F. (1935) Special Rep., General Electric Co., 1405 Locust St., Philadelphia, Pa.

Longsdorf, Paul Wright (1929) Pres., Paul W. Longsdorf, Inc., 8125 Forrest Ave., Elkins Park, Pa.

Looney, William Henry (1935) City Engr., 517 Jefferson Ave., Stambaugh, Mich.

Loughlin, J. A. (1939) City Engr., City Hall, Wilmington, N. C.

Love, H. J. (Assoc.-1925) Mgr., National Slag Assn., 644 Earle Bldg., Washington, D. C.

Lovett, Frank Wm. (Assoc.-1933) Sanitary Engr., Link-Belt Co., 300 W. 39th St., Chicago, Ill.

Lovett, Sanford C. (1939) Supt. of Light, Bureau of Eng., 445 City-County Bldg., Pittsburgh, Pa.

Lovewell, Maurice N. (1912) 7631 Luella Ave., Chicago, Ill.

Loving, M. W. (Assoc.-1923) Secy., Am. Concrete Pipe Assn., 33 W. Grand Ave., Chicago, Ill.

Lyle, John M. (1933) Cons. Engr., Room 408, 650 S. Spring St., Los Angeles, Calif.

Lyons, Robert S. (1932) Asst. Supt. of Way, Philadelphia Transportation Co., 7162 N. 20th St., Philadelphia, Pa.

MacDonald, David R. (1940) City Engr., City Hall, Bismarck, N. Dak.

MacDonnell, Charles (1931) Asst. Engr., 5465 Euclid Ave., Philadelphia, Pa.

MacMurray, Paul (1938) Field Supervisor, Bur. of Highways & Street Cleaning, 926 City Hall Annex, Philadelphia, Pa.

McCartt, L. E. (1935) City Engr., City Bldg., Covington, Ky.

McClelland, J. Bruce (1938) Supt. of Bldgs., The Free Library of Philadelphia, Philadelphia, Pa.

McDermott, Charles P. (1929) Chief Clerk, Bureau of City Property, 712 City Hall, Philadelphia, Pa.

McDevitt, Frank J. (1934) Director, Streets & Sewers, City Hall, St. Louis, Mo.

McFaul, William Lawrence (1924) City Engr., Mgr. Water Works, & Bldg. Comr., City Hall, Hamilton, Ontario, Can.

McGrew, E. J. (Jr.) (1938) Deputy Comr. of Public Works, 1800 Municipal Bldg., New York, N. Y.

McGruder, M. J. (1939) City Engr., City Hall, Lexington, Ky.

McJoynt, John A. (1935) General Mgr., Terminal Service Co., 716 First National Bank Bldg., Cincinnati, Ohio.

McKernan, Chas. A. (1931) Comr. Public Works, City Hall, Utica, N. Y.

McKiernan, John F. (1939) Comr. of Public Works, 306 City Hall, Peoria, Ill.

McLaughlin, T. J. (1938) Township Engr., Township Rooms, Cranford, N. J.

McVea, J. C. (1919) Municipal Improvements Engr., 1318 Kipling St., Houston, Tex.

Maetzel, Paul W. (1935) City Engr., City Hall, Columbus, Ohio.

Magliano, Hilario (Dr.) (Assoc.-1937) Decano de la Facultad de Ciencias Fisicomatematicas, Calle 47, esquina 1, La Plata, Argentina.

Mahony, J. J. (1921) City Clerk, St. Johns, Newfoundland.

Maier, Harry L. (1919) Chief Engr., Street & Sewer Dept., 229 N. Connell St., Wilmington, Del.

Mallery, Earl D. (1936) Executive Director, Am. Municipal Assn., 1313 E. 60th St., Chicago, Ill.

Mann, Karl M. (Assoc.-1930) Pres., "Municipal Sanitation," & "Water Works Engineering," 24 W. 40th St., New York, N. Y.

Mansfield, Myron G. (1933) Morris Knowles, Inc., Cons. Engrs., 507 Westinghouse Bldg., Pittsburgh, Pa.

Marker, James R. (Senior-1907) Civil Engr., Public Relations, Hartman Bldg., Columbus, Ohio.

Marks, Nathaniel L. (Jr.) (1936) City Engr., 21 City Hall, New Orleans, La.

Marsh, Burton W. (1931) Director, Safety & Traffic Eng. Dept., Am. Automobile Assn., Pennsylvania Ave. at 17th St., Washington, D. C.

Marston, Frank A. (1922) Partner, Metcalf & Eddy, 1300 Statler Bldg., Boston, Mass.

Marth, Oscar (1936) Asst. Supervisor, Section Tests & Matls., Dept. of Public Works, 34 Court St., Rochester, N. Y.

Martin, George E. (1933) Cons. Engr., The Barrett Co., 40 Rector St., New York, N. Y.

Martin, John L. (1932) Supt. of Way, Philadelphia Transportation Co., 820 W. Dauphin St., Philadelphia, Pa.

Martini, Nicholas (1938) Director of Public Works, Municipal Bldg., Passaic, N. J.

Marvin, Charles W. (1937) Asst. Engr., 52 City Hall, Rochester, N. Y.

Masterson, Leo J. (1931) Asst. City Planning Engr., Bureau of Eng., Surveys & Zoning, 3608 N. 19th St., Philadelphia, Pa.

Matzat, Francis H. (1937) Asst. Engr., Div. of Eng. 52 City Hall, Rochester, N. Y.

Maxcy, Charles J. (1935) Director, Finance and Accounts, U. S. Housing Authority, 1629 Columbia Rd., N. W., Washington, D. C.

Maxwell, Charles W. (1938) Pres., Albany Gravel Co., Inc., Loudonville Rd., Albany, N. Y.

Meade, Harold E. (1932) Vice-Pres., New Orleans Public Service, Inc., 317 Baronne St., New Orleans, La.

Mebus, Charles F. (1920) Cons. Engr., 112 S. Easton Rd., Glenside, Pa.

Meck, William L. (1931) Principal Asst. Surveyor, Bureau of Eng., Surveys & Zoning, Edison & Dana Aves., Philadelphia, Pa.

Meckley, E. W. (1925) City Engr., City Hall, Allentown, Pa.

Metz, Herbert H. (1926) Borough Engr., 20 S. Richardson Ave., Lansdale, Pa.

Mickle, D. Grant (1937) Traffic & Safety Engr., Michigan State Highway Dept., Lansing, Mich.

Miller, C. H. (Assoc.-1923) Mgr., Vitrified Dept., Laclede Christy Clay Products Co., 1711 Ambassador Bldg., St. Louis, Mo.

Miller, Edwin A. (1926) Supervisor of Maint., Dept. of Public Works, 54 Court St., Rochester, N. Y.

Miller, W. C. (1937) City Engr. & Treas., City Hall, St. Thomas, Ontario, Can.

Mintzer, Howard K. (1936) Supervising Estimator, Bureau of Highways, 5312 Oxford St., West Philadelphia, Pa.

Mitchell, Louis (1935) Dean of Eng. & Cons. Engr., College of Applied Science, Syracuse University, Syracuse, N. Y.

Mitchell, Robert A. (1931) Traffic Engr., Dept. Public Safety, 790 City Hall, Philadelphia, Pa.

Moe, Gustave A. (1928) General Field Supervisor, Public Administration Service, 11 Beacon St., Boston, Mass.

Mohr, John (1935) Dept. of Public Works, 1213 Throgmorton Ave., Bronx, New York, N. Y.

Mondello, Anthony G. (Assoc.-1932) Mgr., Dependable Eng. & Contracting, 1741 W. Erie Ave., Philadelphia, Pa.

Mooney, George S. (1940) Industrial Comr., Montreal Industrial & Economic Bureau, 806 Dominion Sq. Bldg., Montreal, Que., Can.

Moore, Thomas William (Jr.) (1938) Supervisor, Township of Union, Municipal Offices, Union, N. J.

Moorhouse, John H. (1936) Supt., Dept. of Public Service, 30 Gerald Ave., Highland Park, Mich.

Morgan, J. W. (1939) Comr. of Public Improvements, City Hall, Birmingham, Ala.

Moring, James F. (1939) Acting City Engr., City Hall, Evanston, Ill.

Morrison, Thomas J. (1934) 373 Grand Ave., Rochester, N. Y.

Moser, Albert W. (1931) Asst. City Planning Engr., Bureau of Eng., Surveys, & Zoning, 1103 City Hall Annex, Philadelphia, Pa.

Moser, Erwin U. (1940) City Engr., P. O. Box 87, Logan, Utah.

Moulthrop, H. R. (1936) Asst. Engr., Dept. of Public Works, 34 Pinnacle Rd., Rochester, N. Y.

Mudaliar, M. C. Gajaraj (1938) "A" Block, No. 7, O.U.B. Project, Jamai-Osmania, Lallaguda (Deccan), India.

Mulryan, David E. (1936) Asst. Engr., Dept. of Public Works, 426 Bay St., Rochester, N. Y.

Mulvihill, Frances J. (1928) Consultant; Planner; Coordinator, 1028 Connecticut Ave., N. W., Washington, D. C.

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Murray, Edward J. (1934) Director of Public Works, City Hall, Yonkers, N. Y.

Murray, Matt S. (1926) Missouri Work Projects Administrator, 5800 Wyandotte, Kansas City, Mo.

Mussina, Lyons (1921) City Engr., City Hall, Williamsport, Pa.

Myers, Ernest S. (1932) Vice-Pres., New Orleans Public Service, Inc., 317 Baronne St., New Orleans, La.

Naquin, Arthur J. (1932) Transportation Engr., New Orleans Public Service, Inc., 317 Baronne St., New Orleans, La.

Neeson, John H. (1925) Director of Public Works, City Hall Annex, Philadelphia, Pa.

Neis, Robert E. (1936) City Director, City Hall, Monroe, Mich.

Nelson, J. Harry (Assoc.-1937) City Mgr., City Hall, Bay City, Mich.

Nichols, A. C. City Mgr., City Hall, Greenwood, S. C.

Nichols, Charles S. (1937) 2386 S.W. 13th St., City Hall, Miami, Fla.

Nilles, Philip C. (1932) Supt. of Equipment, Bureau of Streets, 2324 S. Ashland Ave., Chicago, Ill.

Noack, Arthur (1926) State Director, N. J. Geodetic Control Survey; Cons. Engr., 60 Outwater Lane, Garfield, N. J.

Norton, James G. (1934) City Engr., City Hall, Kingston, N. Y.

Nunlist, H. A. (Assoc.-1935) Pres., J. A. Stewart Eng. Co., 1011 Traction Bldg., Cincinnati, Ohio.

Nygard, Carl O. (1929) Supt. of Incineration, Riverside Destructor, 2850 20th Ave. S., Minneapolis, Minn.

Ogden, W. H. H. (Jr.) (1929) Surveyor & Regulator, 3rd District, 1129 City Hall Annex, Philadelphia, Pa.

Ohrt, Frederick (1935) Mgr. & Chief Engr., Bd. of Water Supply, P. O. Box 3347, Honolulu, T. H.

Older, T. Fred (1936) Mgr. of Public Utilities, 125 W. Michigan Ave., Ypsilanti, Mich.

Oldham, George E. (1937) 1226 16th Ave. S., Nashville, Tenn.

Oliver, Elmer L. (1936) Asst. Engr., Dept. of Public Works, 52 City Hall, Rochester, N. Y.

Olmsted, Frederick Law (Senior-1909) Landscape Architect, Olmsted Bros., 99 Warren St., Brookline, Mass.

Olson, H. M. (1940) Mgr. Water Softener Div., Ohio Salt Co., 171 Longue Vue Dr., Mt. Lebanon, Pa.

Olson, Herbert A. (1936) Mich. Municipal League, 205 S. State St., Ann Arbor, Mich.

Ostrander, V. L. (1929) Asst. Mgr., Asphalt Sales Dept., Shell Oil Co., Inc., 50 W. 50th St., New York, N. Y.

Outzen, A. N. (1926) Supt. River Rouge Plant, Michigan Consolidated Gas Co., & Supt., Natural Gas Receiving Station, P. O. Box 96, Dearborn, Mich.

Owen, Mark B. (1928) Vice-Pres., Nichols Eng. & Research Corp. of New York, 60 Wall Tower, New York, N. Y.

Paffrath, Ernest H. (1929) Asst. Sewer Comr., 2322 Clark Ave., St. Louis, Mo.

Palmer, I. Charles (1931) Div. Engr., Div. of Sewers, 420 City-County Bldg., Pittsburgh, Pa.

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Passos, Edison (1939) Secy. to Bd. of Public Works, Rua Monte Alegre 314, Rio de Janeiro, Brazil.

Paterson, A. B. (1929) Pres., New Orleans Public Service Inc., 317 Baronne St., New Orleans, La.

Patton, Marion C. (1933) Asst. Gen. Mgr., Armco Drainage Products Assn., 701 Curtis St., Middletown, Ohio.

Patzig, Monroe L. (1918) Testing Engr., Patzig Testing Laboratories, 2215 Ingersoll Ave., Des Moines, Iowa.

Paul, Frederick T. (1930) City Engr., 203 City Hall, Minneapolis, Minn.

Paulson, D. O. (Assoc.-1921) Pres., Municipal Supply Co., 2508-18 S. Main St., South Bend, Ind.

Pav, Anton (1938) Comr. of Public Works, 6700 W. 26th St., Berwyn, Ill.

Pearse, Langdon (1919) Sanitary Engr., Sanitary Dist. of Chicago, 910 S. Michigan Ave., Chicago, Ill.

Pease, Fred A. (1926) Pres., F. A. Pease Eng. Co., 1211 Terminal Tower, Cleveland, Ohio.

Peck, Leon F. (1913) Supt. of City Streets & Supt. Highways, Metropolitan District, Hartford County, Municipal Bldg., Hartford, Conn.

Peirce, Walter A. (1936) Mgr., Water Dept., City Hall, Racine, Wis.

Pennybacker, J. E. (Assoc.-1919) Managing Director, The Asphalt Institute, 801 Second Ave., New York, N. Y.

Perkins, William C. (Senior-1907) Chief Engr., Eastern Paving Brick Assn., Langhorne, Pa.

Perrine, J. Franklin (1921) Engr. of Sewers, Borough of Queens, Borough Hall, Long Island City, N. Y.

Perring, Henry G. (1921) Cons. Engr., Perring & Remington Co., 10 W. Chase St., Baltimore, Md.

Philips, James H. (1931) Chief Engr., Essex County Park Com., 115 Clifton Ave., Newark, N. J.

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Phillips, James (Jr.) (1934) Supt., Incineration, Dept. Public Works, P. O. Box 4, Yonkers, N. Y.

Phillips, Roy L. (1918) City Engr., City Bldg., Meadville, Pa.

Piatt, William M. (1926) Cons. Engr., Rm. 1205, 111 Corcoran St. Bldg., Durham, N. C.

Pinel, Stanley I. (1936) Research Director, Am. Public Works Assn., 1313 E. 60th St., Chicago, Ill.

Pinker, George W. (1932) Div. Supt., Bureau of Street Cleaning, 5328 N. Camac St., Philadelphia, Pa.

Pittsburgh-Des Moines Steel Company (Assoc.-1930) Neville Island Station, Pittsburgh, Pa.

Polk, Wesley W. (1936) Comr. Public Works, Comr. Streets & Supt. Water Dept., City Hall, Evanston, Ill.

Pollock, James R. (1935) City Mgr. & Director of Public Works & Utilities, City Hall, Flint, Mich.

Post, Ruben W. (1937) Supt. St. Lighting, 54 Court St., Rochester, N. Y.

Potter, Alexander (1922) Cons. Sanitary & Hydraulic Engr., 50 Church St., New York, N. Y.

Powell, John M. (1922) City Engr., City Hall, Elyria, Ohio.

Prince, Elmer W. (1935) City Mgr. & City Engr., City Hall, Morgantown, W. Va.

Quinlan, Patrick H. (1932) Drainage Engr., Sewerage & Water Board, 526 Carondelet St., New Orleans, La.

Quirk, J. Henry (1937) City Engr., City Bldg., Bradford, Pa.

Rainville, Walter S. (Jr.) (Assoc.-1932) Railway Dept., New Orleans Public Service Inc., 317 Baronne St., New Orleans, La.

Raisch, William (1926) Cons. Engr., 227 Fulton St., New York, N. Y.

Randall, Robert H. (1939) Consultant, Natl. Resources Planning Bd., N. Interior Bldg., Washington, D. C.

Rangel, L. A. de Souza (1936) Chief Engr., Dept. of Public Works, Rua Buenos Ayres, No. 93-3 andar, Rio de Janeiro, Brazil.

Rankin, E. S. (Senior-1903; Honorary-1938) Div. Engr., Div. of Sewers, City Hall, Newark, N. J.

Ratcliffe, Robert C. (1937) 2395 Francisco St., San Francisco, Calif.

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Renard, Eugene, Charles (1931) Res. Engr. Inspector, PWA, 480 Oakwood, Webster Groves, Mo.

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Reynolds, Harry J. (1939) 350 E. Weber Rd., Columbus, Ohio.

Ribal, Raymond R. (1939) Designing Draftsman, Dept. of Eng. City Hall, Oakland, Calif.

Richards, Arthur (1928) Engr. Exec., Municipal Bldg., Larchmont, N. Y.

Richardson, Frederick F. (1939) Director of Public Works, City Hall, New Brunswick, N. J.

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Rowe, Ernest J. (1931) Supt., Water & Light Dept., 110 Maple Ave., Wellsville, N. Y.

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Rush, Benjamin F. (1933) Chief Engr., Dept. of Public Works, City Hall, Honolulu, T. H.

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Sanborn, George H. (1936) Deputy Comr., Public Works, 315 DeForest Road, Syracuse, N. Y.

Sandenburgh, George H. (1923) City Engr., City Hall, Ann Arbor, Mich.

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Saville, Thorndike (1935) Dean & Prof. of Hydraulic & Sanitary Eng., New York University, Box 65, University Heights, New York, N. Y.

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Shifrin, Hymen (Life-1922) Cons. Engr., 1312 International Office Bldg., St. Louis, Mo.

Shimoda, Yoshito (Dr.) (1937) Director, Osaka Municipal Hygienic Lab., Osaka, Japan.

Shisler, John A. (1936) City Civil Engr., City Hall, Canton, Ohio.

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Skelly, Joseph P. (1930) Comr. of Public Property, City Hall Annex, New Orleans, La.

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Smith Leon A. (1930) Supt., Water Works, City Hall, Madison, Wis.

Smith, Meloy (1937) Cons. Engr., 16 State St., Rochester, N. Y.

Smith, Nathan L. (1937) Cons. Engr., 1201 St. Paul St., Baltimore, Md.

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Soper, George A. (1931) Cons. Engr, Middle Neck Rd., Great Neck, N. Y.

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Stone, Donald C. (1930) Asst. Director, Div. of Administrative Management, Bureau of Budget, Executive Office of the President, Washington, D. C.

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Storrie, William (1920) Cons. Engr., Gore & Storrie, 1130 Bay St., Toronto, Ontario, Can.

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Sydow, William (1928) Director of Public Service, City Hall, Miami, Fla.

Taggett, Vernon N. (1939) City Engr., P. O. Box 167, Niles, Mich.

Talbot, A. N. (Senior-1896) Prof. of Municipal & Sanitary Eng., Emeritus, University of Illinois, Urbana, Ill.

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Taylor, Henry W. (1935) Cons. Engr., 11 Park Place, New York, N. Y.

Taylor, Ralph C. (1934) Supt., Waste Collection Div., Room 350, City Hall, Cincinnati, Ohio.

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Terrill, R. V. (1939) City Engr., City Hall, Coldwater, Mich.

Thatcher, E. Fusz (1938) City Engr., City Hall, Ferguson, Mo.

Thomas, Frank L. (1931) Professional Engr., 556 Hermit Lane, Roxborough, Philadelphia, Pa.

Thompson, George R. (1938) City Engr., City Hall, Detroit, Mich.

Thorpe, Frederick Thomas (Jr.) (1929) Surveyor & Regulator, 1129 Sanger St., Frankford, Philadelphia, Pa.

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Tocchini, Ralph P. (1939) Supt. Waste Disposal, 1926 Tuolumne St., Fresno, Calif.

Tolles, William H. (1934) Supt. of Streets, Municipal Bldg., Nashua, N. H.

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Torrance, Langham (1931) Surveyor, 6th Survey District, 931 W. Lehigh Ave., Philadelphia, Pa.

Townsend, Alfred Ames (1932) Registered Professional Engr., 718 Carpenter Lane, Mt. Airy, Philadelphia, Pa.

Townsend, Darwin W. (1931) Cons. Engr., Consoer, Townsend & Quinlan, 839 N. Marshall St., Milwaukee, Wis.

Traeger, S. A. (1938) Supt., Sanitation Dept., City Hall, Minneapolis, Minn.

Transeau, T. Elmer (1932) Director, Bureau of Highways & Safety, Dept. Revenue, State Capitol, Harrisburg, Pa.

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Upham, Charles (1926) Secy. & Engr.-Director, Am. Road Builders Assn., Natl. Press Bldg., Washington, D. C.

Vagtborg, Harold (1936) Prof. Sanitary & Municipal Eng., Director, Research Foundation, Armour Institute of Technology, 3300 Federal St., Chicago, Ill.

Van Lieu, Samuel E. (1939) Asst. Supt., Waste Collection Div., 350 City Hall, Cincinnati, Ohio.

Van Trump, Isaac (1911) Director, Van Trump Testing Lab., 329 S. Wood St., Chicago, Ill., & 218-223 Terminal Warehouse Bldg., Little Rock, Ark.

Varney, Henry A. (1916) Town Engr., 25 Town Hall, Brookline, Mass.

Veatch, N. T. (Jr.) (1920) Black & Veatch, Cons. Engrs., 4706 Broadway, Kansas City, Mo.

Vedder, Arthur L. (1937) Supt. of Surveys, Div. of Eng., Dept. of Public Works, 52 City Hall, Rochester, N. Y.

Veitch, Wm. M. (1932) City Engr., City Hall, London, Ontario, Can.

Velz, Clarence J. (1939) Prof. Sanitary Eng. & Head of Civil Eng. Dept., Manhattan College, New York, N. Y.

Vincenz, Jean L. (1936) Comr. Public Works & City Engr., City Hall, Fresno, Calif.

Vogt, Carl G. (1938) Supt. Maintenance & Repair, Street Dept., City Hall, East Orange, N. J.

von Phul, William (1911) Pres., Ford, Bacon & Davis, Inc., 39 Broadway, New York, N. Y.

Wagener, A. H. (1937) Director, Planning, Dept. of Commerce, 54 Court St., Rochester, N. Y.

Wagner, C. F. (1923) Chief Engr., J. B. McCrary Co., 22 Marietta St. Bldg., Atlanta, Ga.

Waite, Henry M. (1935) Chairman, Public Works Committee, Natl. Resources Planning Bd., Brighton Hotel, Washington, D. C.

Walker, E. H. (1937) Structural Designer, City Engr's. Office, City Hall Annex, Rochester, N. Y.

Walker, Guy B. (1939) City Engr., City Hall, Wilkes-Barre, Pa.

Walker, Stanton (1926) Director of Eng., Natl. Sand & Gravel Assn., Munsey Bldg., Washington, D. C.

Wallner, George (1939) City Engr. & Supt. Water Works, City Hall, Iron Mountain, Mich.

Walls, C. A. (1938) Comr. Public Works, Village Hall, Oak Park, Ill.

Walter, Albert G. (1922) City Engr., City Hall, Dunkirk, N. Y.

Walter Motor Truck Company (Assoc.-1926) 1001-1019 Irving Ave., Queens, Ridgewood, N. Y.

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Warren, Ralph L. (Senior-1905) Vice-Pres., Treas. & Director, Warren Bros. Co., P. O. Box 1869, Boston, Mass.

Watson, H. Wallace (1931) Senior Surveyor, 10th Dist., Bureau of Eng., Surveys & Zoning, 1059 Allengrove St., Frankford, Philadelphia, Pa.

Weaver, Stuart M. (1937) Executive Asst. to Director of Public Works, & Supt. of Water Bureau, City Hall, Montclair, N. J.

Webb, Curtis C. (Assoc.-1937) Director, Municipal Research & Service, 200 City Hall, Louisville, Ky.

Webb, J. D. (1934) City Engr., City Hall, Birmingham, Ala.

Weber, B. B. (1917) City Engr., City Hall, Oil City, Pa.

Weir, Weldon (1938) Director of Public Works, City Hall, Asheville, N. C.

Welch, Thomas H. (1937) Supervisor, Waste Disposal, City Hall, Schenectady, N. Y.

Weller, W. Earl (1937) Director, Rochester Bureau of Municipal Research, 45 Exchange St., Rochester, N. Y.

Weston, Robert Spurr (1914) Cons. Engr., Weston & Sampson, 14 Beacon St., Boston, Mass.

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Williams, J. A. (Assoc.-1910) Vice-Pres., Saint Mary's Sewer Pipe Co., Saint Mary's, Pa.

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Willigerod, W. D. (1913) City Engr., City Hall, East Orange, N. J.

Wilson, Carl F. (1938) Supt., Dept. of Public Works, City Hall, Corning, N. Y.

Wilson, Joseph Hull (1936) Engr., Solvay Sales Corp., 2240 Lake Road Blvd., N. W., Canton, Ohio.

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Wise, B. A. (1916) Bradford, Pa.

Wolfe, Thomas F. (1924) Research Engr., The Cast Iron Pipe Research Assn., 122 S. Michigan Ave., Chicago, Ill.

Wolfinger, Wellington R. (1918) Contractor & Engr., Curren Terrace, Norristown, Pa.

Wolman, Abel (1921) Chairman, Natl. Water Resources Com., Prof., Sanitary Eng., Johns Hopkins University, Homewood, Baltimore, Md.

Wood, E. A. (1927) Street Cleaning & Scavenging Div., Dept. of Health, City Hall Annex, Winnipeg, Manitoba, Can.

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Wrenn, Lewis M. (1935) City Engr., City Hall, Pontiac, Mich.
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Huntsville—Ford, F. H., Pres., City Council, P. O. Box 84.
Mobile—Fisher, Harry L., City Engr., City Hall.
Montgomery—Garrett, Roy Stuart, Asst. City Engr., City Hall.

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CONNECTICUT

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Fairfield—Butzko, Stephen E., Supervisor Roads & Bridges, Town Hall.
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Budapest—Ballo, Alfred (Dr.), Director, Dept. of Public Cleansing.

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NEWFOUNDLAND

St. Johns—Mahony, J. J., City Clerk.

PARAGUAY

Asuncion—Durham, Henry Welles (Col.), c/o American Legation.

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PROFESSIONAL AND COMMERCIAL ANNOUNCEMENTS

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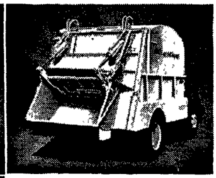

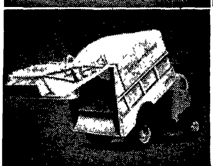

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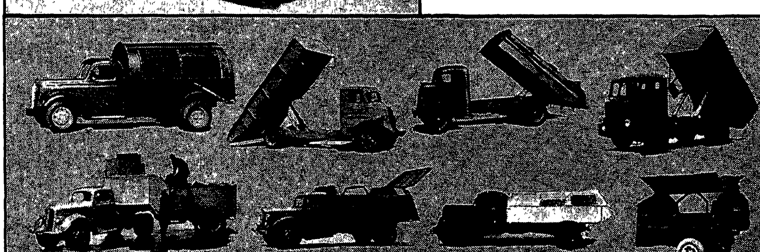

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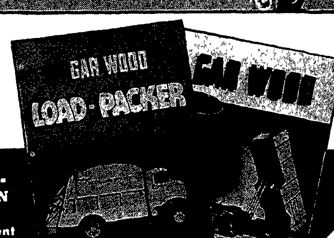

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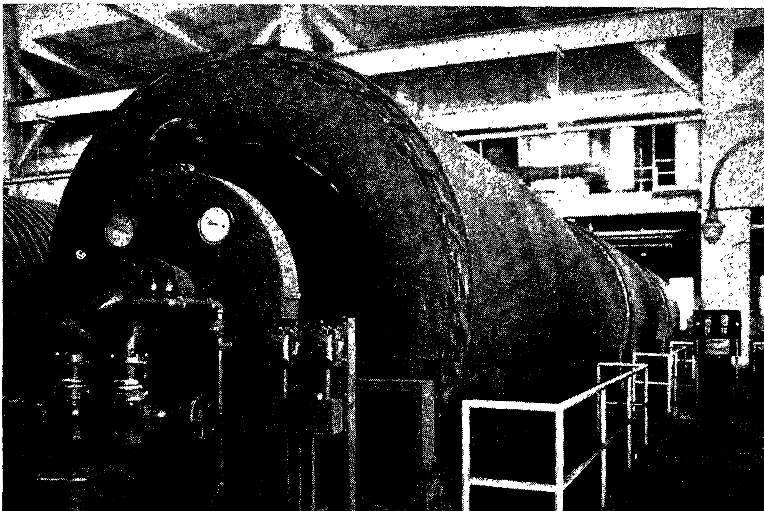

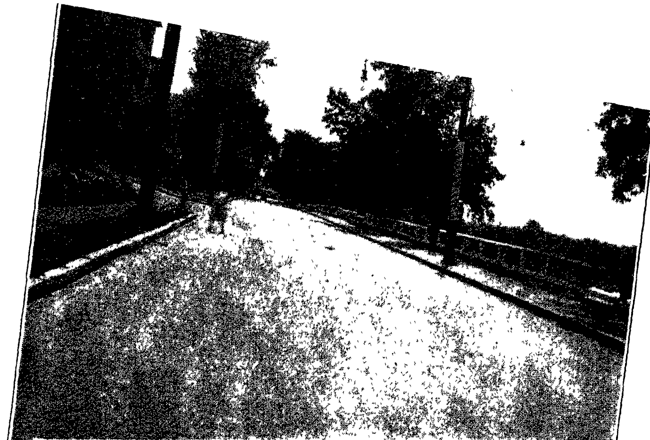

1,250,000 sq. yds. of paving in New England's 3rd largest city

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No need to ask Worcester officials their opinion of the durability and economy of upkeep of TEXACO Asphalt construction. The impressive yardage they have laid over a period of many years speaks plainly for itself.

Today, more than 1500 representative American cities drive on TEXACO-paved streets.

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